

Coastal Zone  
Information  
Center

HE  
554  
.A6  
P68  
1982  
c.2

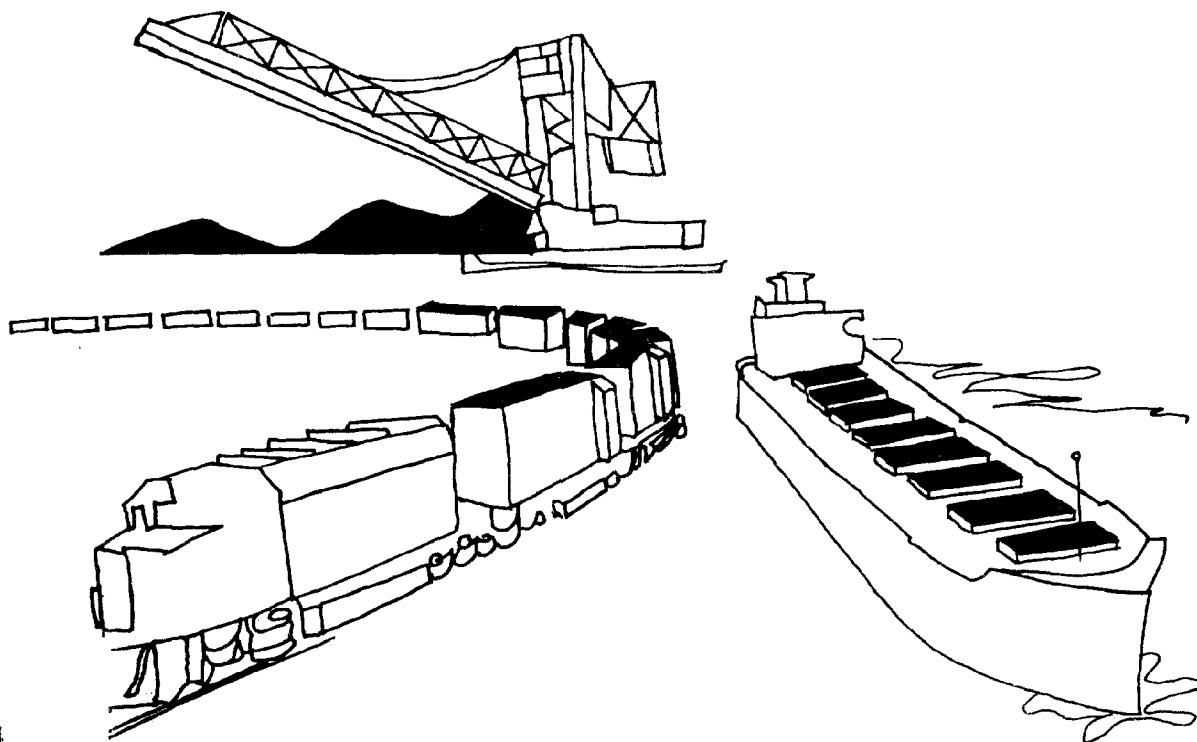
Library of Congress  
Environmental  
Division

# Potential Coal Export Facilities in Washington

## *An Environmental Impact Analysis*

Washington  
Public Ports Association

CZIC collection



HIE  
554  
.A6  
P68  
1982  
c.2

sociation with: Reid, Middleton and Associates, Inc. Williams-Kuebelbeck and Associates, Inc.

POTENTIAL COAL EXPORT FACILITIES  
IN WASHINGTON  
AN ENVIRONMENTAL IMPACT ANALYSIS

CZIC collection

A Study Conducted By:

Kramer, Chin & Mayo, Inc.

in association with:

Reid, Middleton and Associates, Inc.

Williams-Kuebelbeck and Associates, Inc.

U. S. DEPARTMENT OF COMMERCE NOAA  
COASTAL SERVICES CENTER  
2234 SOUTH HOBSON AVENUE  
CHARLESTON, SC 29405-2413  
For the:

Washington Public Ports Association

Washington Department of Ecology

This document was financed by a grant from the Washington Department of Ecology with funds of the National Oceanic and Atmospheric Administration and appropriated for Section 308 of the Coastal Zone Management Act of 1972.

October 1982

Property of CGC Library

HESSY.A6 P68 1982 C-2  
1050801  
6870089

## WASHINGTON PUBLIC PORTS ASSOCIATION

Post Office Box 1518  
Olympia, Washington 98507  
Telephone (206) 943-0760

### OFFICERS FOR 1982 - 1983

John H. Stevens - Grays Harbor ..... President  
Ralph G. Nolte - Longview ..... Vice President  
John J. McLaughlin - Pend Oreille ..... Secretary  
Douglas P. Edison - Olympia ..... Treasurer  
L. T. Pepin - Walla Walla ..... Past-President

### STAFF

Lewis R. Holcomb, Executive Director  
Donald R. White, Assistant Director  
Robin F. Torner, Information Officer  
A. R. (Sue) Johnson, Office Manager  
Patricia A. Shultz, Secretary  
Kenneth R. Ahlf, Counsel

### COOPERATIVE DEVELOPMENT COMMITTEE

Stanley Lattin, Port of Grays Harbor, Chairman  
Harry Winder, Port of Everett, Vice-Chairman  
Arthur Yoshioka, Port of Seattle  
Ken Kirkland, Port of Anacortes  
Hugh Wilson, Port of Bellingham  
William Ryan, Port of Skagit County  
Paul Vick, Port of Port Angeles  
Herb Effron, Port of Bremerton  
George Yount, Port of Port Townsend  
Gary Kucinski, Port of Tacoma  
Douglas Edison, Port of Olympia  
Marshall Briggs, Port of Willapa Harbor  
Robert Petersen, Port of Ilwaco  
John Fratt, Port of Kalama  
Robert McNannay, Port of Longview  
Larry Hendrickson, Port of Skamania County  
Benson Murphy, Port of Vancouver  
Jack Israel, Port of Camas-Washougal  
Bill Hemingway, Port of Klickitat County No. 1  
Dean Rainwater, Port of Woodland  
Richard Harris, Port of Chelan County  
Dean Hagerty, Port of Moses Lake  
James Keane, Port of Pasco  
Sue Watkins, Port of Kennewick  
Jay Holman, Port of Benton  
James Beddow, Port of Walla Walla  
William Behrens, Port of Clarkston

### ADDITIONAL STUDY PARTICIPANTS

John Anderson, Department of Commerce & Economic Development  
Frank Urabeck, U.S. Army Corps of Engineers  
Frank Huxtable, Maritime Administration  
Nancy Nelson and David Stout, U.S. Fish & Wildlife Service  
Mary Lou Mills, Department of Fisheries  
John DeMeyer, Department of Natural Resources  
Joe Williams, Department of Ecology  
Dave Gufler, Department of Game

### OBSERVERS

Leona Thomas, Washington Environmental Council  
Harry Kemery, Lone Star Industries  
Dale Moss, Tulalip Tribal Council  
Nancy Pearson, League of Women Voters

### STUDY TEAM

#### Kramer, Chin & Mayo, Inc.

Richard E. Warren, Project Manager	
Gary W. Harshman, Project Leader	
Dorr Anderson	Roberta A. Johnson
Margaret Arevalo	Gretchen K. Leslie
Patricia J. Asper	George Mitacek
Vicki L. Berger	John C. McGlenn
Kristi Farley	Karen J. Pike
Martha E. Grasso	Monica L. Sanchez
Shirley M. Hume	

#### Reid, Middleton and Associates, Inc.

Jerrold K. Hann  
John O. Olsen

#### Williams-Kuebelbeck and Associates, Inc.

Gregory R. Easton  
Patricia M. Englin

#### Others

Ogden Beeman, Ogden Beeman & Associates  
Render D. Denson, Applied Environmental Consultants  
Skip W. Urling, Independent Consultant

## TABLE OF CONTENTS

	<u>Page</u>
Table of Contents	i
List of Tables	iii
List of Figures	iv
Glossary of Acronyms	vi
 I. STUDY SUMMARY	 1-1
Introduction	1-1
Background	1-1
Study Scope	1-2
Study Results	1-2
 II. STEAM COAL MARKET SHARE	 2-1
Introduction	2-1
Summary	2-1
Evaluation of Other Studies	2-3
West Coast Coal Terminals	2-8
Forecasts of Western United States Steam Coal Exports	2-9
 III. TRANSPORTATION MODES AND ROUTES	 3-1
Railroad Transportation	3-1
Burlington Northern, Inc.	3-1
Union Pacific Railroad	3-2
Rail Traffic and Routes	3-2
On-line Communities	3-3
Railroad Access to Potential Coal Port Sites	3-4
Environmental Issues Associated with Rail Transport	3-9
Slurry Pipeline	3-10
Barge Transportation	3-11
 IV. PORT FACILITY CAPACITY REQUIREMENTS	 4-1
 V. PHYSICAL SITE REQUIREMENTS	 5-1
Facility Component Requirements	5-1
Permit and Approval Requirements	5-6
 VI. ENVIRONMENTAL IMPACT POTENTIAL	 6-1
Introduction	6-1
Potential Impact Issues	6-1

TABLE OF CONTENTS (Continued)

VII.	SITE-SPECIFIC EVALUATIONS	7-1
VIII.	IMPACT AVOIDANCE MEASURES	8-1
	Introduction	8-1
	Siting Measures	8-1
	Design and Operation Measures	8-3
	Mitigation Measures	8-5
	Economic Evaluation Summary of Impact Avoidance	8-5
	References	
	Appendices	
	A. Detailed Economic Analysis of Impact Avoidance Measures	A-1

# LIST OF TABLES

Table No.	Title	Page
1	Forecasts of Western United States Steam Coal Exports	2-3
2	Western United States Steam Coal Exports	2-4
3	West Coast Coal Export Studies Major Assumptions -- Steam Coal Only	2-6
4	Pacific Rim Total Import Demand for Steam Coal by Country	2-8
5	Planned Coal Terminals in United States and Canadian West Coast	2-10
6	Potential West Coast Terminal Sites	2-11
7	Forecasts for Western United States Steam Coal Exports	2-14
8	Washington Communities on Principal Rail Routes	3-5
9	Coal Port Capacity Requirements Basic Assumptions	5-2
10	Coal Port Design Alternatives	5-6
11	Typical Coal Port Permit Requirements	5-8
12	Centralia Steam Plant NPDES Permit Requirements	5-10
13	Checklist Model Potential Impacts	6-2
14	Summary of Potential and Actual Particulate Emissions at 15 Million Tons per Year Located at Kalama, Washington	6-4
15	Potential Pollutant Mass Concentration in Fugitive Coal Dust Emissions	6-5
16	Expected Pollutant Concentrations in Coal Pile Leachate	6-7
17	Potential Taxes on Coal Facility	6-14
18	Impact Avoidance Measures	8-2
19	Coal Port Runoff Treatment Elements	8-4
20	Summary of Impact Avoidance Costs	8-7

# LIST OF FIGURES

Figure No.	Title	Follows Page
1	System Summary Step Matrix	1-2
2	Rail Transport Routes to NW Ports	3-2
3A	Coal Train Traffic and Routes Northern Puget Sound	3-4
3B	Coal Train Traffic and Routes Southern Puget Sound and Grays Harbor	3-4
3C	Coal Train Traffic and Routes Kalama/Vancouver Sites	3-4
4	Schematic of Slurry Pipeline System	3-10
5	Component 1: Ship size and Frequency	4-2
6	Component 2: Ship/Apron Transfer Capability	4-2
7	Component 5: Inland Transfer Processing	4-2
8	Component 6: Inland Transport Unit Processing Capability	4-2
9	General Flow Schematic	5-2
10	Small Port Configuration	5-2
11	Large Port Configuration	5-2
12	Critical Path - Permit Preparation and Processing	5-8
13	Locations of Specific Ports Profiled	7-2
14	Cherry Point Terminal Site	7-3
15	Anacortes Terminal Site	7-6
16	Tulalip Terminal Site	7-9
17	Steilacoom Terminal Site	7-12
18	Grays Harbor Terminal Site	7-15
19	Kalama Terminal Site	7-18
20	Vancouver Terminal Site	7-21

LIST OF FIGURES (Continued)

21	Potential Impact Issues/Impact Avoidance Measures Matrix	8-2
22	Total Cost of Coal	8-6

# GLOSSARY OF ACRONYMS

BACT	-	best available control technology
BNRR	-	Burlington Northern Railroad
CPSEDD	-	Central Puget Sound Economic Development District
DOE	-	Washington Department of Ecology
DSHS	-	Washington Department of Social and Health Services
FWS	-	U.S. Fish and Wildlife Service
ICE	-	Interagency Coal Export Task Force
MarAd	-	U.S. Maritime Administration
MLLW	-	mean lower low water
MSL	-	mean sea level
NEPA	-	National Environmental Policy Act
NMFS	-	National Marine Fisheries Service
NPDES	-	National Pollution Discharge Elimination System
SEPA	-	State Environmental Policy Act
SPCC	-	Spill Prevention Control and Countermeasures Plan
UPRR	-	Union Pacific Railroad
WESTPO	-	Western Governors' Policy Office
WDF	-	Washington Department of Fisheries
WDG	-	Washington Department of Game
WOCOL	-	World Coal Study
WPPA	-	Washington Public Ports Association

## I. STUDY SUMMARY

### Introduction

This study, sponsored by the Washington Public Ports Association and the State Department of Ecology, was designed to promote responsible and informed decision-making by state and local agencies, ports and project sponsors, and to enhance understanding for all persons interested in the issue of coal export planning and development in Washington state. Study activities involved a coordinated research effort, primarily using existing information, to characterize: (1) coal export activities as they are likely to occur; (2) major transportation issues associated with these coal port activities; (3) export facility site requirements; (4) environmental impacts and issues raised by this type of development; (5) prospective port sites; and (6) potential impact avoidance measures.

This project provided a unique opportunity for regulatory agency and port management representatives to formulate a consensus of important environmental issues related to coal port development. As the study progressed, a basis of common understanding evolved as to those potential impacts which would have to be addressed and reviewed in detail for any proposed coal port project in the state.

### Background

The dwindling prospects for any substantial increase in the supply of oil at acceptable prices is a primary reason for the increased importance of and attention given to coal. Even with the most optimistic forecasts for the expansion of nuclear power and the aggressive development of all other energy sources, as well as vigorous conservation, it is clear that coal has a vitally important part to play in the world's energy future.

Recent studies and reports indicate a need to develop the capacity of west coast ports for the transshipment and export of large quantities of coal over the next 10 to 20 years. Information from these and other recent studies was used as part of this report.

- o A draft U.S. Department of Energy study discussed in Bulk Systems, May 1980, predicts export levels of 24.5 million tons by 1990. In addition, increases in domestic consumption during the same time period are expected to involve an unknown degree of coastal transshipping which will add to port capacity needs.
- o More recently, the U.S. Department of Energy's 1981 Interagency Coal Export Task Force Interim Report states that Asian steam coal imports could amount to 90 million tons by the year 1990. Japan could account for more than half this total demand.
- o The 1982 Western Coal Export Task Force - Pacific Basin Steam Coal Export Study predicts that coal consumption by the Pacific rim nations of Japan, South Korea and Taiwan will total close to 60 million tons by 1985. By 1990, western U.S. coal may comprise as much as one-quarter of approximately 100 million tons of far east coal demand.

much as one-quarter of approximately 100 million tons of far east coal demand.

Development of export facilities in Washington state is consistent with the national purpose and need for coal export capacity. Further, this kind of development helps to promote a larger national goal for shifting the global energy economy more away from the petroleum-producing nations and more toward the U.S. and its resources.

### Study Scope

The guiding methodology for this project included the following study elements:

- o Identification of typical coal facility components
- o Identification of typical coal facility operations
- o A projection of potential impacts resulting from facility construction and operation
- o Identification of practical impact avoidance measures

The step matrix presented in Figure 1 provides an overview of the relationship between these study elements. Specific facility components are listed and matched up by dots in Matrix 1 to facility operations necessary for the construction, operation and maintenance of a coal export facility. Matrix 2 shows how the different facility operations give rise to specific issues of potential environmental impact. These potential impact issues are matched in Matrix 3 to an array of applicable impact avoidance measures. The purpose of this step matrix is not only to illustrate the cause and effect relationship between project implementation and subsequent ecological and social impacts and impact avoidance measures but to also help identify for the decision-maker those specific resources and environmental factors of most concern with respect to a possible development site. Alternatively, the affect of specific impact avoidance measures on facility operations and components can also be determined.

The geographical scope of this study included all port areas in Washington state and major existing and potential transportation routes servicing these port areas. Although specific ports were analyzed (e.g., Cherry Point, Anacortes, Tulalip, Seattle, Tacoma, Steilacoom, Grays Harbor, Kalama, Vancouver, and others), the method of impact analysis formulated during the project, and documented in the study report, is applicable to any aspiring port area in Washington state.

### Study Results

The initial task of this study was to identify the likely share of U.S. coal exports to move through Washington ports. This effort centered around a review of recent national, regional and local studies. This included information from the 1980 Port Systems Study, the 1981 U.S. Department of Energy's Interagency Coal Export Task Force Interim Report, and the 1982 Pacific Basin Steam Coal Export Study, among other documents.



The primary market for western U.S. coal is acknowledged to be Pacific rim nations. Asian countries are expected to increase their demand for coal at a rate of 14.3 percent per year through the year 2000 as these countries seek to replace petroleum for electrical generation and other uses. Japan, in particular, seeks to secure coal sources in Australia, Canada, China, and the U.S. to avoid excessive concentration of supply with a single source. Thus, the U.S. share is likely to be a specified percentage of total Asian demand.

Based upon analyses of assumptions used in past projections combined with considerations of current economic conservatism and a resulting softening of the present coal market:

- o Pacific Northwest exports are anticipated to be in the range of 30 million tons per year by the year 2000.

This represents an anticipated 70 percent share of all west coast exports.

An examination of prospective transportation modes and routes for this coal was also included in this study. Although barge transport and slurry pipelines are addressed, the major focus has been on rail transport.

Although some alternate and overflow lines exist, the major routes for coal transport include:

- o The Stevens Pass line via Wenatchee to Everett which is the primary route for traffic destined for stops north of Tacoma.
- o The Columbia River line via Tri-Cities to Vancouver which carries rail traffic destined for sites south of Tacoma.

An analysis of physical site requirements included a determination of state-wide marine terminal facility requirements necessary to meet the market demands assessed at the outset of this study. Utilizing the MarAd methodology for capacity determinations, a series of charts was developed which illustrates relationships between coal throughput volumes and sizes of critical facility components. This evaluation covers the basic physical requirements of a major coal export facility including: number and size of berths; land requirements; water channel and berthing depths; rail and truck access; material handling and storage.

Based upon the market share, physical site requirements analyses and sizes of proposed facilities:

- o The capacity requirement for the northwest (all Washington State ports and Oregon ports along the Columbia River) is on the order of two to three coal port facilities. The exact number and location of these ports will ultimately depend upon identification of specific customers and establishment of long-term contracts.

Scenarios were developed to describe and illustrate the typical layout and facility components of both large and small sizes of facilities (see Figures 10 and 11). These scenarios lay the groundwork from which a model of environmental impact was developed.

The impact model presented in this study includes all critical elements of the physical, biological and socio-economic environments. This checklist appears in Figure 1 as the list of potential impact issues.

Specific sites in the state of Washington were evaluated in relation to the generic impact model. These sites include: Cherry Point, Anacortes, Tulalip, Steilacoom (Lone Star), Grays Harbor, Kalama and Vancouver. Detailed profiles on each of these sites generally described:

- o The proposed project development
- o Site location and capacity
- o The setting at and around the site
- o Area land use designations
- o Public facility requirements
- o Constraints to development
- o Development opportunities

This information was developed from data supplied by the individual ports involved, data available to the KCM team from previous port studies, and data from other existing published documents and reports. Work also included one on-site work session at each prospective port to verify and refine site data discussed above.

These site-specific evaluations also included an analysis of critical environmental issues associated with each site.

Specific impact avoidance measures (those listed in Figure 1) were evaluated in response to specific impacts identified. A cost-effectiveness evaluation of these measures was also presented, and cheaper alternatives for impact avoidance were identified where possible. Most impact avoidance measures have a very small effect on the total cost of coal. However, restriction of facility operations and enclosure of coal piles appear to be major factors which could affect the ultimate financial feasibility of one coal port site over another. Appendix A provides a detailed discussion of the economics of impact avoidance.

It is the conclusion of this study that environmentally acceptable coal export facilities can be developed in the state of Washington within the context of the anticipated market share for the Pacific Northwest. Although the number and location of these facilities will depend upon the nature of specific signed contracts, avoidance of unacceptable environmental impact can be accomplished through prudent siting of facilities, effective design and operational measures and direct mitigation activities.

## II. STEAM COAL MARKET SHARE ANALYSIS

### Introduction

This discussion presents an overview of current market conditions for steam coal exports to Pacific rim countries (Japan, Taiwan, Korea, Indonesia, Hong Kong, and the Philippines). The purpose of the market analysis is not to develop new forecasts of west coast and Washington state coal exports, but rather to evaluate assumptions in the several studies that have been done and to recommend the most probable export levels in future years.

A distinction is made in the previous studies between steam coal, which is used in the generation of electricity, and metallurgical coal, a higher-grade coal used in the production of steel. Only steam coal exports are considered in this market study, since most coal mined in the Rocky Mountain states and shipped to Pacific rim countries through west coast ports does not possess enough heat energy potential to be classified as metallurgical coal.

The remainder of this chapter details the market share analysis and is organized in three additional sections:

- o Evaluation of Other Studies
- o West Coast Coal Terminals
- o Forecasts of Western United States Steam Coal Exports

### Summary

Several studies have looked at west coast steam coal markets in great detail. They include:

1. 1980 Port System Study, conducted by the Washington Public Ports Association in 1980.
2. Coal - Bridge to the Future, a report of the World Coal Study, directed by MIT. Completed in 1980.
3. Interim Report of the Interagency Coal Export Task Force (ICE Study), prepared by the U.S. Department of Energy, published in January 1981.
4. Western Coal Exports Final Report, a six-volume report completed for the Western Governors' Policy Office (WESTPO)\* in December 1981.
5. Puget Sound Coal Export Opportunities and Issues, a Central Puget Sound Economic Development District (CPSEDD) publication, printed in February 1982.

---

\* The WESTPO Study brought together coal producers, railroads, ports, port developers, foreign buyers, and the western governors to study and foster long-term, large-volume steam coal exports to Pacific rim markets.

Using these studies as a starting point, recommended forecasts for steam coal exports were developed (see Table 3). Key assumptions in the forecasts were:

- o Electrical energy demand growth rates in Pacific rim countries will be 6 percent per year in Japan and Taiwan, and 10 percent per year in the Republic of Korea and other Pacific rim countries.
- o Coal-generated electricity will provide between 7 and 25 percent of new energy in Pacific rim countries.
- o The western U.S market share of far east steam coal imports will be approximately 14 percent in 1985, increasing to 20 percent in the year 2000.
- o Pacific northwest ports are expected to export 40 percent of all U.S. west coast (including Alaska) steam coal in 1985, increasing to approximately 70 percent of all exports in the year 2000. Pacific northwest ports include all Washington state ports and Columbia River ports in Oregon and Washington.
- o Total Pacific rim steam coal demand is assumed to be:

	<u>Millions of Short Tons</u>
1985	55.0
1990	105.0
1995	150.0
2000	207.5

Based on these assumptions, study forecasts of steam coal exports are summarized in Table 1. As shown, present U.S. steam coal exports of about 5 million short tons per year are expected to increase to 41.5 million short tons in the year 2000. Pacific northwest coal exports are forecast to total about 30 million short tons per year by the year 2000.

The sensitivity of these forecasts is highly dependent on the accuracy of electrical demand growth rates in Pacific rim countries, the role of nuclear energy in these countries, and the need by far east countries to diversity and stabilize their coal suppliers.

In addition, it is likely that there will be a short-term delay of planned west coast coal terminals due to lower oil prices, which have slowed conversion of oil-run industrial plants, decreased South African coal prices, and a general slow-down in the far east economy, which has reduced overall industrial energy demand.

TABLE 1

FORECASTS OF WESTERN UNITED STATES STEAM COAL EXPORTS  
(Millions of Short Tons)

	<u>U.S. West Coast</u>	<u>Pacific Northwest</u>
Present	5.0	0
1985	7.5	3.0
1990	18.5	9.0
1995	30.0	18.0
2000	41.5	30.0

These forecasts cannot take into account individual contracts between west coast ports and Pacific rim buyers, which can greatly vary the origin and amount of steam coal exports. As a result, the market analysis only gives a general indication of Pacific rim demand.

#### Evaluation of Other Studies

This discussion summarizes projections from recent coal studies, as well as the assumptions supporting those projections. Review of each of the studies cited is recommended for a more complete examination of potential west coast steam coal exports.

#### Comparison of Projections

Current steam coal exports from the U.S. west coast total approximately 5 million tons, primarily from ports in Long Beach and Los Angeles. Another 1 to 2 million tons of steam coal were shipped to Pacific rim countries from western Canada last year. The remainder of Canadian coal exports, shipped through British Columbia, consisted of metallurgical coal.

Projections of western U.S. steam coal exports (in short tons) are presented in Table 2. As shown, five major studies made forecasts between 1980 and 1982. Most of the later studies expanded upon the previous reports. As a result, the more recent studies, especially the WESTPO report, are more comprehensive and also more likely to be accurate.

1985 projections vary significantly, from 4.8 million tons annually (World Coal Study) to 9.8 million tons (CPSEDD). The result is a wide variance in year 2000 projections, from 35.1 million tons annually (ICE Study) to 48 million tons (World Coal Study).

TABLE 2

WESTERN UNITED STATES STEAM COAL EXPORTS  
(Comparison of Projections)

	<u>Millions of Short Tons per Year</u>			
	Projected			
	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
1. <u>Puget Sound Coal Export Opportunities and Issues</u> - Central Puget Sound Economic Development District (CPSEDD) 1982	9.8	23.9	33.9	46.6
2. <u>Western Coal Exports Final Report</u> - Western Governors' Policy Office (WESTPO) 1982	8.4	19.9	31.5	43.0
3. <u>Interim Report</u> - U.S. Interagency Coal Export Task Force (ICE) 1981	5.1	11.7	23.4	35.1
4. <u>Coal - Bridge to the Future</u> - World Coal Study 1980	4.8	17.5	32.8	48.0
5. <u>1980 Port System Study</u> - Washington Public Ports Association (WPPA) 1980	8.1	17.7	25.9	43.8

Sources: CPSEDD  
WESTPO  
ICE  
World Coal Study  
WPPA

## Major Assumptions

Several key assumptions are used in these other studies in forecasting Pacific northwest coal exports including (1) future electrical energy consumption growth in Pacific rim countries, (2) coal as a share of new energy growth, (3) western U.S. share of the far east steam coal market. Table 3 presents a summary of assumptions from each of the studies previously mentioned. Each assumption is described in more detail below. It should be noted that, since the scope of each study differs, all of the assumptions are not dealt with explicitly.

### o Future Electrical Energy Consumption Growth in Pacific Rim Countries

An important base assumption included in all of the studies is the potential need for steam coal to fuel electrical generating plants in Pacific rim countries. This need for electricity is determined by the projected growth rate of electrical energy consumption in these countries. As shown previously in Table 3, the growth rate between 1985 and 2000 ranges between 3 and 11 percent per year. However, more recent studies have used 6 percent annual growth in Japan and Taiwan and 10 percent growth in Korea and other Pacific rim nations. Since these latter estimated growth rates were forecast by groups within the particular Pacific rim countries in the last year, these projections are considered to be the most accurate at this time.

### o Coal as a Share of New Energy

New energy demands in the Pacific rim countries will likely be met by a combination of coal, nuclear, liquified natural gas (LNG), oil, hydroelectric, geothermal, and solar energy. Because of fluctuations in oil prices and public resistance to nuclear energy, coal is projected to be one of the most important sources of new energy in these countries.

Three of the studies projected coal's share of new energy to be between 6 and 27 percent (see Table 3). Since coal's market share is related directly to nuclear energy growth, forecasts of nuclear's share of new energy are also included in Table 3. The World Coal Study projects nuclear power to provide for almost all of Japan's new energy demands; however, WESTPO predicts nuclear's share to be a bit lower, at 20 to 40 percent. At this time, WESTPO's estimates appear to be more accurate, but any projections of nuclear energy growth are uncertain because of growing problems with nuclear plants, including potential safety hazards and the long lead time required to build a nuclear plant. If nuclear energy becomes less acceptable, coal-fired electricity plants are expected to meet most of the additional electricity demand.

TABLE 3

WEST COAST COAL EXPORT STUDIES  
Major Assumptions -- Steam Coal Only

Name of Study	Future Electrical Energy Consumption Growth in Pacific Rim Countries 1985-2000	Coal as a Share of New Energy-- Pacific Rim	Western U.S. Share of Far East Market	Nuclear as a Share of New Energy-- Pacific Rim	Average BTU's Per Pound of Coal	Pacific NW Share of West Coast Coal Market
Central Puget Sound EDD - CH2M-Hill (Feb. 1982)	6.0% per year	25%	16-19%	35%	10,800	40%-1985 50%-1990 60%-1995 70%-2000
WPPA Study (Nov. 1980)	10.9% per year	No forecast	8-19%	No forecast	No forecast	53%-1985 53%-1990 58%-1995 70%-2000
Interagency Coal Export Study (Jan. 1981)	3.9-3% per year	No forecast	0-25%	No forecast	12,600	No forecast
World Coal Study - MIT (1980)	4.0-4.5% per year	6-17%	10-25%	50-75% (Japan only)	No forecast	No forecast
WESTPO Study (1982)	6% per year-Japan Taiwan	7-27%	25-30%	20-40%	No forecast	Unavailable
	10% per year-Rep. of Korea					

- o Western United States Share of Far East Market

Another very important assumption in all of the coal studies has been the western U.S. share of the Pacific rim steam coal market. Chief suppliers of metallurgical coal to Pacific rim countries include Australia, the United States, Canada, and to a lesser extent, South Africa, the Soviet Union, Poland, and China.

As noted in the ICE Report, it appears likely that the major suppliers of metallurgical coal will also be suppliers of steam coal. Some countries are expected to play an increased role in the steam coal market, like China and South Africa, while others will most likely decrease their coal exports to Pacific rim countries, including Poland and the Soviet Union.

Since large supplies of steam coal are available in the western interior states of Colorado, Utah, Wyoming, and Montana, it can be expected that almost all steam coal exports to the far east will be routed through west coast ports. Thus, the projected U.S. share of Pacific rim countries' steam coal imports will be almost equal to the west coast share. Most of the coal studies have assumed the west coast share of the far east market will increase to between 19 and 30 percent by the year 2000. However, this projection can also vary according to worldwide coal prices and the extent to which the Pacific rim countries feel a need to diversify their steam coal suppliers.

- o Pacific Northwest Share of West Coast Coal Market

Only the CPSEDD Study and the WPPA Study forecast a potential market share of steam coal exports for Pacific northwest ports. It is generally assumed in most of the other studies that steam coal exports in the 1980s will be from California ports because of their proximity to Colorado-Utah coal, which has a relatively high heat content. However, Wyoming-Montana steam coal, which is more plentiful but with a lower heat content, will likely flow through Pacific northwest ports to the far east in the 1990s.

Both studies assumed an increasing share of steam coal exports for Pacific northwest ports as time progresses, up to a 70 percent market share in the year 2000, since Washington state ports are generally closer to Pacific rim markets. The Pacific northwest share includes Columbia River ports in both Washington and Oregon. Market shares to specific ports are not forecast in this study because of the high level of uncertainty involved in making these forecasts.

- o Projections of Pacific Rim Steam Coal Demand

The WESTPO Study provides detailed estimates of Pacific rim demand for steam coal. Table 4 summarizes these estimates, by country. These estimates include steam coal demand from the electric power industry, as well as cement, steel, iron, and other industries. The scope of this study does not allow for a detailed analysis of these

numbers, but extensive discussions of these forecasts are contained in both the WESTPO and the CPSEDD Studies.

TABLE 4

PACIFIC RIM TOTAL IMPORT DEMAND FOR STEAM COAL BY COUNTRY  
(Millions of Tons)

<u>Pacific Rim Country</u>	<u>1981</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Japan	16.2	30.9	62.7	83.3	97.8
Taiwan	4.3	12.7	24.3	35.7	62.7
Korea	1.5	11.9	13.4	27.2	34.7
Other	<u>0.5</u>	<u>7.2</u>	<u>16.4</u>	<u>28.6</u>	<u>42.7</u>
TOTAL	22.5	62.7	121.8	174.8	237.9

Sources: WESTPO  
CPSEDD

West Coast Coal Terminals

As the potential steam coal market in Pacific rim countries becomes more publicized, so do plans for coal terminals at many of the ports on the west coast. Development of specific facilities will affect the demand for facilities at other sites. What is clear at this time, however, is that planned coal terminal capacities are almost double the projected steam coal exports from the west coast in the year 2000.

Planned coal terminals, as well as proposed sites, are discussed in the remainder of this section. Only summary information is provided on each site. More extensive information is presented in the WESTPO Study.

Current Coal Terminals

Two California ports currently handle steam coal exports: Long Beach and Los Angeles. Capacity of each of these terminals is 3 million tons annually. In addition, Stockton, California has a coal storage facility capable of handling about a half million tons annually.

Coal handling facilities also exist in Vancouver, British Columbia. Three terminals, including one at Roberts Bank, and the Neptune and Pacific Coast terminals inside the city of Vancouver, have an annual capacity of 20 million tons. As mentioned earlier, these terminals export metallurgical coal almost exclusively, but conversion to steam coal use is possible as Pacific rim demands increase.

## Planned Coal Terminals

Several west coast ports have definite plans for a coal terminal. Most of these terminals are still in the environmental review stage, while a few ports have obtained the necessary permits for construction. Table 5 summarizes the status of each planned coal terminal. As shown, ports in Portland, Oregon; Kalama, Washington; and Redwood City, California appear closest to actual construction of new facilities. Other planned construction or additions can be ready in the next several years, but actual construction is likely to occur only when definite commitments from Pacific rim importers are received.

In addition, planned expansion in British Columbia is included as part of Table 5. Roberts Bank is expected to double its size from 12 million tons in 1981 to 25 million tons in 1985, eventually handling 40 million tons per year of steam and metallurgical coal by 1990. A new terminal is also being planned at Ridley Island, Prince Rupert with an initial capacity of 9 million tons annually. The Ridley Island terminal is expected to come on line in the next 5 to 10 years. The Pacific and Neptune terminals are not expected to expand because of physical constraints in Vancouver Harbor.

## Potential Coal Terminal Sites

Table 6 presents details on other potential west coast terminal sites, including site owner, size of the property, and existing channel depth. These sites differ from the planned sites in that the EIS and permitting process has not yet begun. As shown, half of the potential sites are located in Washington. Development of these sites will almost certainly be preceded by a definite commitment from a Pacific rim importer. Actual construction at any of these sites may not occur until the 1990s. Sites most likely to change status from potential to planned in the next several years include: Bellingham, Steilacoom (Lone Star), and Tulalip, Washington; Astoria, Oregon; and Selby, California.

## Forecasts of Western United States Steam Coal Exports

Forecast development for this study is presented in this section, along with the assumptions underlying those forecasts. Also included is a discussion of the sensitivity of the forecasts, including an overview of issues relevant to the reliability of the forecasts.

### Assumptions

The following assumptions were used in reaching the recommended forecasts:

- o Electrical energy demand growth rates in Pacific rim countries will be 6 percent per year in Japan and Taiwan, and 10 percent per year in the Republic of Korea and other Pacific rim countries, as assumed in the WESTPO Study.

TABLE 5

PLANNED COAL TERMINALS IN UNITED STATES AND CANADIAN WEST COAST  
(Summary)

<u>Millions of Short Tons</u>				
West Coast Location	Current Capacity	Planned Capacity	Current Status	Year Complete
<u>UNITED STATES</u>				
Los Angeles, CA	3	10-30	Expansion on Terminal Island - 10- to 15-million-ton capacity in Phase I	1983-84
Long Beach, CA	3	10-30	EIR in Progress - 10-million-ton capacity in Phase I	1984-85
Redwood City, CA	0	3-5	EIR nearly complete	1982-83
Portland, OR	0	10-12	Construction is underway	1982-83
Kalama, WA	0	15	EIS complete. Final permits issued.	1982-83
Vancouver, WA	<u>0</u>	<u>3-6</u>	Final EIS complete	1983-84
Total - U.S. (West Coast)	6	51-98		
<u>CANADA</u>				
Roberts Bank, B.C.	12	40	Addition of 12 million tons in Phase I planned	1985
Vancouver, B.C.	8	8	No action planned due to physical constraints of location	--
Ridley Island, B.C.	<u>0</u>	<u>9</u>	Plans for new terminal in process	1985-90
Total - Canada (West Coast)	20	57		

Sources: WESTPO  
WK&A

TABLE 6  
POTENTIAL WEST COAST TERMINAL SITES  
(Summary)

<u>Location</u>	<u>Owner</u>	<u>Size acres</u>	<u>Existing Channel Depth (feet)</u>
Port Hueneme, CA	Port	60+	35
Sacramento, CA	Port	10-300+	32
Stockton, CA	Port	73	32
Benicia, CA	Benicia Industries	150	35
Richmond, CA	Port	Not available	35
San Francisco, CA	Port	70	50
Selby, CA	Wickland Oil Company	308	50
Coos Bay, OR	Port	70	35
Warrenton, OR	Dant & Russel	130	40
Astoria, OR	Port & State	280	40
Longview, WA	Private	325	40
Grays Harbor, WA	Port	176	30
Bellingham, WA (Cherry Point)	Glacier Park	1,100	80+
Anacortes, WA (March Point)	Unidentified	200	60+
Tulalip, WA	Tulalip Tribes	2,200	80+
Everett, WA	Port	1,800	80+
Dupont, WA	Weyerhaeuser	3,200	80+
Steilacoom, WA	Lone Star Industries	400	80+
Steilacoom, WA	Kaiser	Not available	80+
Tacoma, WA	Port	90	80+

TABLE 6 (Continued)

<u>Location</u>	<u>Owner</u>	<u>Size</u> acres	<u>Existing</u> <u>Channel Depth</u> (feet)
Seward, AK	Port	100	Not available
Cordova, AK	City	Not known	Not available

Sources: WESTPO Study  
WK&A

- o Coal will make up between 7 and 25 percent of new energy, based on estimates supplied by Pacific rim countries. In addition, the nuclear share of new energy is assumed to be between 15 and 35 percent to the year 2000.
- o The western U.S. (California, Oregon, and Washington) share of the far east steam coal market is estimated to be about 14 percent in 1985 increasing to 20 percent in the year 2000, assuming the Pacific rim countries will seek to further diversify their coal suppliers in the future.
- o Alaska, an emergent coal exporter, has not developed forecasts.
- o Pacific northwest's share of the west coast steam coal trade will be 40 percent in 1985, 50 percent in 1990, 60 percent in 1995, and 70 percent in 2000. These estimates assume that coal from the northern Rocky Mountain areas, which is more plentiful, will be shipped through Pacific northwest ports.
- o Estimates of Pacific rim import demand for steam coal (as discussed previously) range from 22.5 tons per year in 1981 to 238 tons per year in 2000. These estimates have been revised slightly to reflect a delay in construction of several planned steam coal electrical plants in the last year. These revised estimates are as follows:

<u>Millions of Tons per Year</u>	
1985	55.0
1990	105.0
1995	150.0
2000	207.5

#### Actual Forecasts

Table 7 contains the forecasts developed in this study of western U.S. steam coal exports from 1985 to 2000. Also included are estimates of the Pacific northwest's share of the steam coal trade. As shown, substantial steam coal exports are not expected in the Pacific northwest until the 1990s because of the current capacity and status of California facilities. The remainder of this section contains a discussion of the sensitivity of these forecasts.

#### Sensitivity

Changes in any of the key assumptions could significantly alter these forecasts. Sensitivity of each of the assumptions is discussed below.

- o Electrical energy demand growth forecasts are the key determinant of steam coal plant construction in Pacific rim countries. According to WESTPO participants, the reliability of the energy growth forecasts is very high. Pacific rim countries, particularly Japan, have very sophisticated econometric techniques used in forecasting

energy demand. These estimates were used in the WESTPO Study and are part of the current forecasts.

TABLE 7  
FORECASTS FOR WESTERN UNITED STATES STEAM COAL EXPORTS  
(Millions of Short Tons)

	<u>United States West Coast</u>	<u>Pacific Northwest</u>	<u>Pacific Northwest Share of West Coast Exports</u>
Present	5.0	0	0%
1985	7.5	3.0	40%
1990	18.5	9.0	50%
1995	30.0	18.0	60%
2000	41.5	30.0	70%

- o Coal's share of new energy growth is perhaps the most uncertain variable in the analysis. Since coal is considered to be a residual of nuclear and other energy supplies, the status of these other energy forms is important. Nuclear power is currently meeting stiff public resistance in Japan, in particular. Since nuclear power is estimated to supply up to 35 percent of new energy in Pacific rim countries in the next 20 years, the substitution of coal-generated electricity for nuclear power could greatly change the forecasts. According to the CPSEDD Study, substitution of even one-third of the planned nuclear power with coal would result in about a 15 percent increase in western U.S. coal or about 6 million more tons per year by the year 2000.

In addition, coal-fired plants can be built in four to five years, while nuclear plants require much longer lead times. Thus, the greater flexibility of coal is an added advantage over nuclear power.

- o The western U.S. share of coal exports to Pacific rim countries is another very sensitive variable in the forecasts. The need by these countries for reliable and varied sources for coal may override the cost advantages of other coal suppliers located closer to the Pacific rim countries. This need could greatly increase the role of U.S. coal in the far east.

At this time, Australia supplies almost 50 percent of coal to the Pacific rim countries, but the continued threat of labor disputes may reduce their role slightly in the future. Other countries

supplying coal to the far east, including South Africa, U.S.S.R., and Poland, are politically unstable. Adverse changes in policies in these countries will likely enhance the role of the United States and Canada in the steam coal market. On the other hand, Chinese coal development could offset increases by the United States and Canada. As a result, current estimates of western U.S. market shares are somewhat conservative. An increase from a 20 percent market share in the year 2000 to a 30 percent share could raise U.S. west coast exports by almost 21 million tons per year.

- o The Pacific northwest share of west coast steam coal exports is another variable assumption. Estimates in this study are based on the closer proximity of Pacific northwest ports to far east ports, resulting in reduced travel time and reduced cost per ton of coal. Initial steam coal exports will likely travel through California ports because of their closeness to more desirable southern Rocky Mountain coal mines. However, as these supplies become more difficult to mine in the late 1980s, most coal exports will be routed through Pacific northwest ports from Montana and Wyoming coal mines, where coal has less heat content, but is more plentiful and easier to mine.

The Pacific Northwest (all Washington marine locations and Columbia River ports in Oregon and Washington) market share is projected to be about 30 million tons by the year 2000. However, actual locations and number of terminals depend on commitments from Pacific rim importers, physical and political site advantages, and capacities of individual facilities.

Alaska's share of the market is not included in this forecast since coal reserves in that state are not expected to be mined until after the year 2000. If reserves near Cordova and Seward are exported to Pacific rim countries before 2000, it is likely these exports will directly reduce the Pacific northwest market share, assuming the price of Alaska steam coal is competitive.

### III. TRANSPORTATION MODES AND ROUTES

#### Railroad Transportation

Rail transportation of export coal within the state of Washington to transshipment terminals at Washington ports will be via the lines of Burlington Northern, Inc. and the Union Pacific Railroad. Coal is a major source of traffic for these railroads, which are continually modernizing their facilities and equipment through large capital expenditure programs. Union Pacific transported 28 million tons of coal in 1980, while 100 million tons originated on the lines of Burlington Northern in that year making coal the largest single commodity handled by Burlington Northern. Most of this traffic was destined for electric utilities in the midwest and the southwest, although in the first half of 1981 Union Pacific transported some 2.5 million tons of coal for export through west coast ports.

High capacity port transshipment facilities will enable the operation of single commodity unit trains, which generally consist of 100 cars and have a train load capacity of about 10,000 tons of coal. Unit trains consist of dedicated locomotives and cars which remain coupled as a train, operating on a schedule between single points of origin and destination. The cars are typically shipper-owned, while locomotives are provided by the railroad. Unit train operations frequently involve more than a single railroad with dedicated motive power from one or more of the railroads remaining with the train throughout its round trip cycles.

The major deposits of coal in western states which could be transshipped economically through Washington ports are located in the states of Montana, Wyoming, Utah and Colorado. Most of the coal resources being mined or planned for development in Montana and Wyoming are in the Powder River Basin. This area of eastern Montana and northeast Wyoming is served principally by lines of Burlington Northern. Union Pacific serves the coal producing regions of southwest Wyoming, as well as receiving coal traffic from major deposits in Utah and Western Colorado through interchange with the Denver and Rio Grande Western Railroad and the Utah Railway.

As a result of regulatory changes in the Staggers Rail Act of 1980 recently passed by congress, railroads gained added flexibility in ratemaking and are now able to negotiate long term contracts for rail transportation of commodities such as coal. The routing of export coal from various points of origin in Montana, Wyoming, Utah and Colorado to Washington ports is subject to commercial arrangements among the coal supplier and purchaser and the railroads.

#### Burlington Northern, Inc.

Export coal traffic to Washington ports from the Powder River Basin would originate principally on Burlington Northern lines in southeast Montana and northeast Wyoming (see Figure 2). This traffic would be routed to Billings, Montana and westward via BN's mainline route through Missoula, Montana and Sand Point, Idaho to Spokane. Beyond Spokane three alternate mainline routes are available to port sites in western Washington.

The primary BN route for traffic destined for points south of Tacoma proceeds southwest from Spokane to Pasco and Kennewick, then follows the north bank of the Columbia River to Vancouver, Washington. There it connects with BN's north-south mainline which runs from Vancouver, Washington to Vancouver, B.C. via Tacoma, Seattle, Everett and Bellingham. The parallel mainlines of two predecessor railroads are operated by BN as eastbound and westbound paired track between Cheney and Pasco.

The second BN mainline, which is the primary route for traffic destined for points north of Tacoma, proceeds west from Spokane to Wenatchee, crosses the Cascade Mountains at an elevation of 2,883 feet via Stevens Pass and the eight-mile Cascade Tunnel, and descends to tidewater at Everett where it connects with the north-south mainline.

The third mainline route across the Cascades is now used primarily for local traffic and to supplement the more operationally-efficient Stevens Pass line. This route follows the Columbia River route southwest to Pasco and Kennewick, then heads northwest to Yakima and Ellensburg, crosses the Cascade Mountains at an elevation of 2,820 feet via Stampede Pass, and connects with the north-south mainline at Auburn. Burlington Northern has purchased the former Milwaukee Road/Snoqualmie Pass line, which crosses the Cascades at an elevation of 2,564 feet. This line which is not currently operational is to be improved to provide a more favorable gradient and another alternate mainline across the Cascades, when the necessary track improvements are warranted by increased traffic. Connections to the parallel Stampede Pass line will be made near Easton on the east side of the Cascades and Ravensdale on the west side.

#### Union Pacific Railroad

Coal traffic from southwest Wyoming, Utah and Colorado destined for Washington ports would be carried on the lines of the Union Pacific. Coal trains from Wyoming would be routed via Granger, Wyoming (see Figure 2) to Pocatello, Idaho. Coal traffic from mines in Utah and Colorado would be received by Union Pacific at interchange points with the Denver and Rio Grande Western Railroad and the Utah Railway, and would be routed northward from Ogden, Utah to Pocatello, Idaho. Beyond Pocatello this traffic would follow the Union Pacific mainline to Boise, Idaho and Pendleton, Oregon, following the south bank of the Columbia River to Portland.

From north Portland, Oregon to Tacoma, Washington, the Union Pacific operates over the double track line of the Burlington Northern. North from Tacoma, Union Pacific has its own mainline to Seattle, the northern terminus of the Union Pacific line. The Union Pacific and Burlington Northern maintain separate branch lines to Grays Harbor from the Burlington Northern mainline at Centralia.

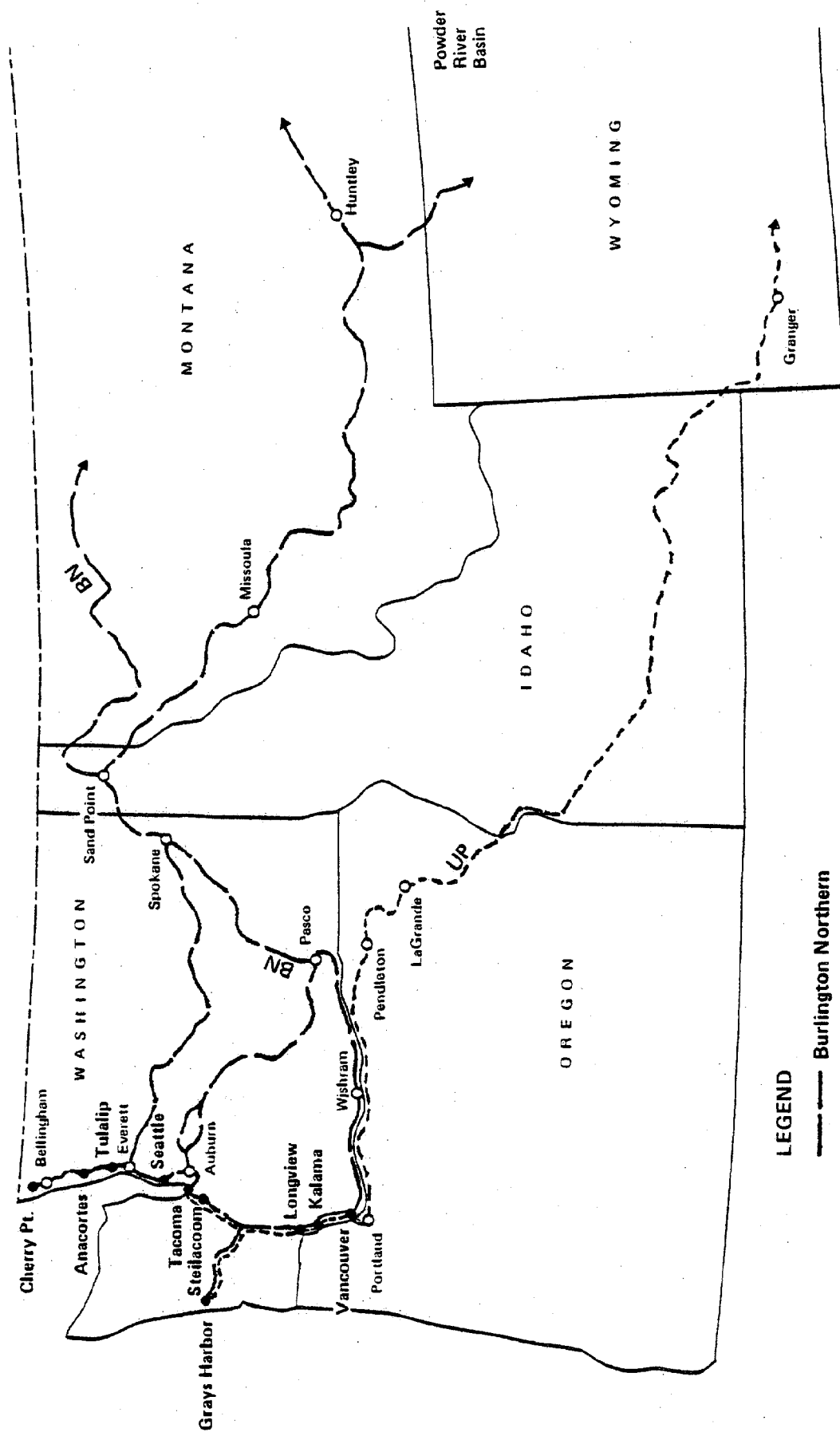
In addition to connections at Portland, the Union Pacific mainline along the south bank of the Columbia River has connections with Burlington Northern mainlines in the vicinities of Wallula, Washington, and Portland, Oregon.

#### Rail Traffic and Routes

The principal rail routes within Washington for transportation of coal to Washington coal port sites from the Powder River Basin, via Burlington

Figure 2

RAIL TRANSPORT ROUTES TO NW PORTS



Northern, and from Utah, Colorado and southwest Wyoming, via Union Pacific, are shown in Figures 3A, 3B and 3C. Increased train movements attributable to coal unit train operation to any one of the ports shown are indicated. The figures show average daily numbers of trains operated over segments of these lines in 1980, a pre-recession year, representing relatively normal traffic volumes. (1) The increased numbers of daily trains with coal traffic added is also shown for each line segment. Theoretical daily train capacity ranges based on generalized track configurations and signal systems on these line segments are indicated on the diagrams. (2) The coal traffic volumes entering the state via Spokane on the Burlington Northern or via Portland on the Union Pacific illustrate the maximum potential impact on rail traffic volumes on the principal rail access routes for any one of the port sites shown in the figures. The average of four unit train loads per day through either gateway represent an annual total of approximately 14.6 million tons, or one half of the 30 million tons projected to be exported through Washington coal ports in the year 2000. The eight daily coal train movements, considering both directions of travel, would be additive when considering the combined impact of two coal ports which would use a common segment of rail line for access.

The daily train volumes shown do not include growth in traffic for other commodities handled over these rail routes. Substantial increases in the general level of rail traffic across the Cascades will result in distribution of traffic over the alternate routes according to available line capacity and incremental cost of operations. The railroads foresee no major problems in providing adequate line capacity to accommodate projected levels of coal traffic. Lead time between commitments for a coal port facility and initiation of substantial coal traffic will be adequate to make any necessary track and signal improvements.

#### On-line Communities

Communities located on the principal rail route(s) serving each of the potential coal port sites are listed in Table 8. Principal routes are shown for Powder River Basin coal traffic on the Burlington Northern via Spokane, and for Utah, Colorado and southwest Wyoming coal traffic on the Union Pacific via Portland. Use of the Stampede Pass/Snoqualmie Pass route as an alternate BN route to coal export facilities at Steilacoom and Grays Harbor assumes an overall increase in the level of rail traffic which would warrant improvement of the former Milwaukee Road line over Snoqualmie Pass.

---

1. Average daily trains are derived from freight traffic density charts for 1980 as submitted by the I.C.C. and average gross tons per freight train for the western district. Source: Western Coal Exports to the Pacific Basin-Report 4, Overland Transportation Task Group, Western Coal Export Task Force.

2. Estimated line capacity is based on track configuration (single or double track) and signal system (no signals, automatic block signals, or centralized traffic control). Source: Ibid

assumes an overall increase in the level of rail traffic which would warrant improvement of the former Milwaukee Road line over Snoqualmie Pass.

#### Railroad Access to Potential Coal Port Sites

The coal port sites under consideration at Vancouver, Kalama, Grays Harbor and Steilacoom are on or near lines of both the Burlington Northern and Union Pacific, and would be served directly by both of these carriers. The Tulalip, Anacortes and Cherry Point sites are on lines of the Burlington Northern. Coal traffic routed to these ports via the Union Pacific would likely be interchanged with Burlington Northern at some point south of Seattle, the northern terminal of the Union Pacific in the Puget Sound area (although the exchange could also take place in Portland). Routing of such UP-BN interchange traffic with Washington state and division of the haul between the railroads will depend on commercial arrangements between the carriers and the coal producers and suppliers. Interchange points with the Burlington Northern Railroad exist at several points on the Union Pacific between the Wallula area and Seattle.

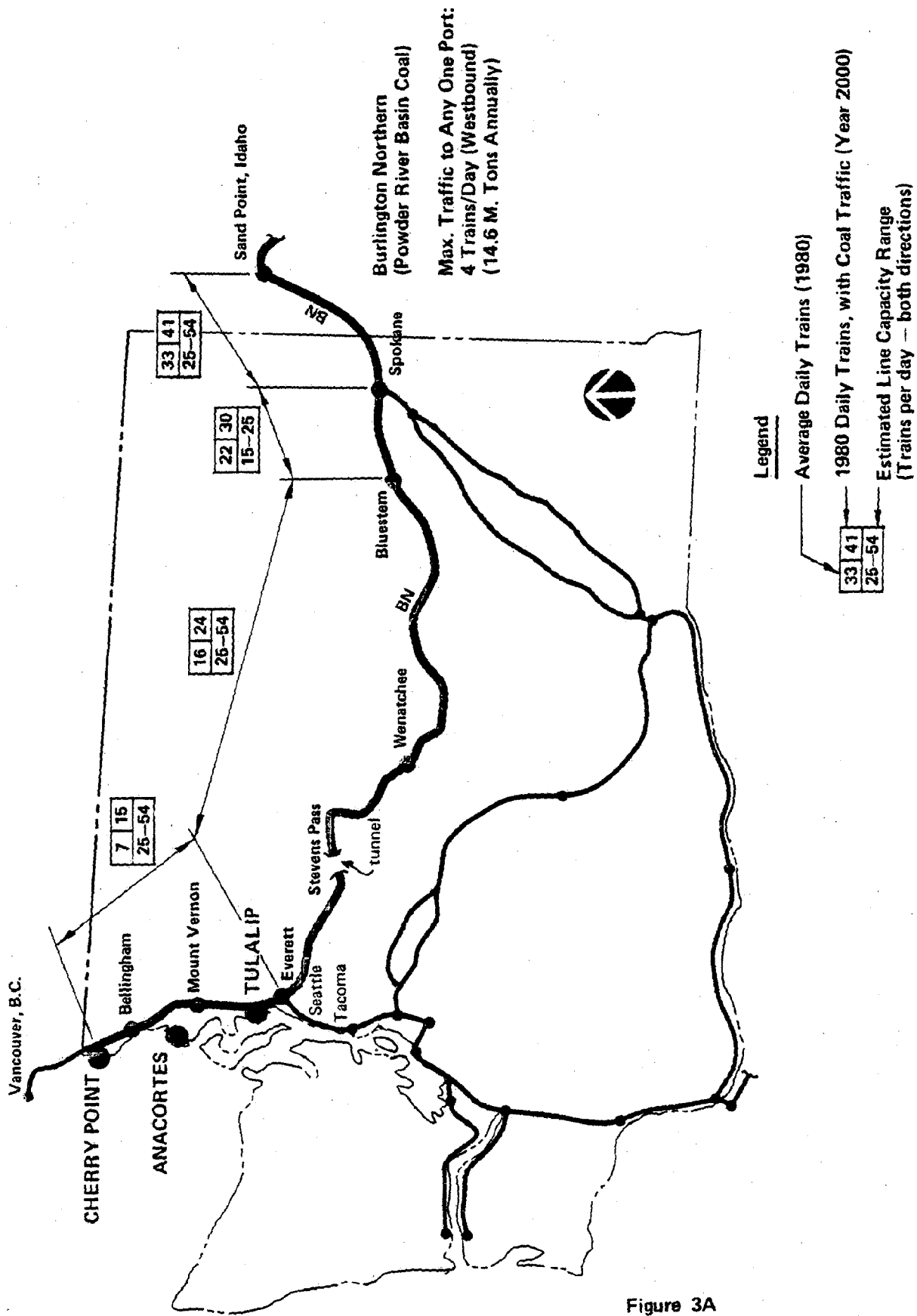


Figure 3A

Coal Train Traffic and Routes  
Northern Puget Sound



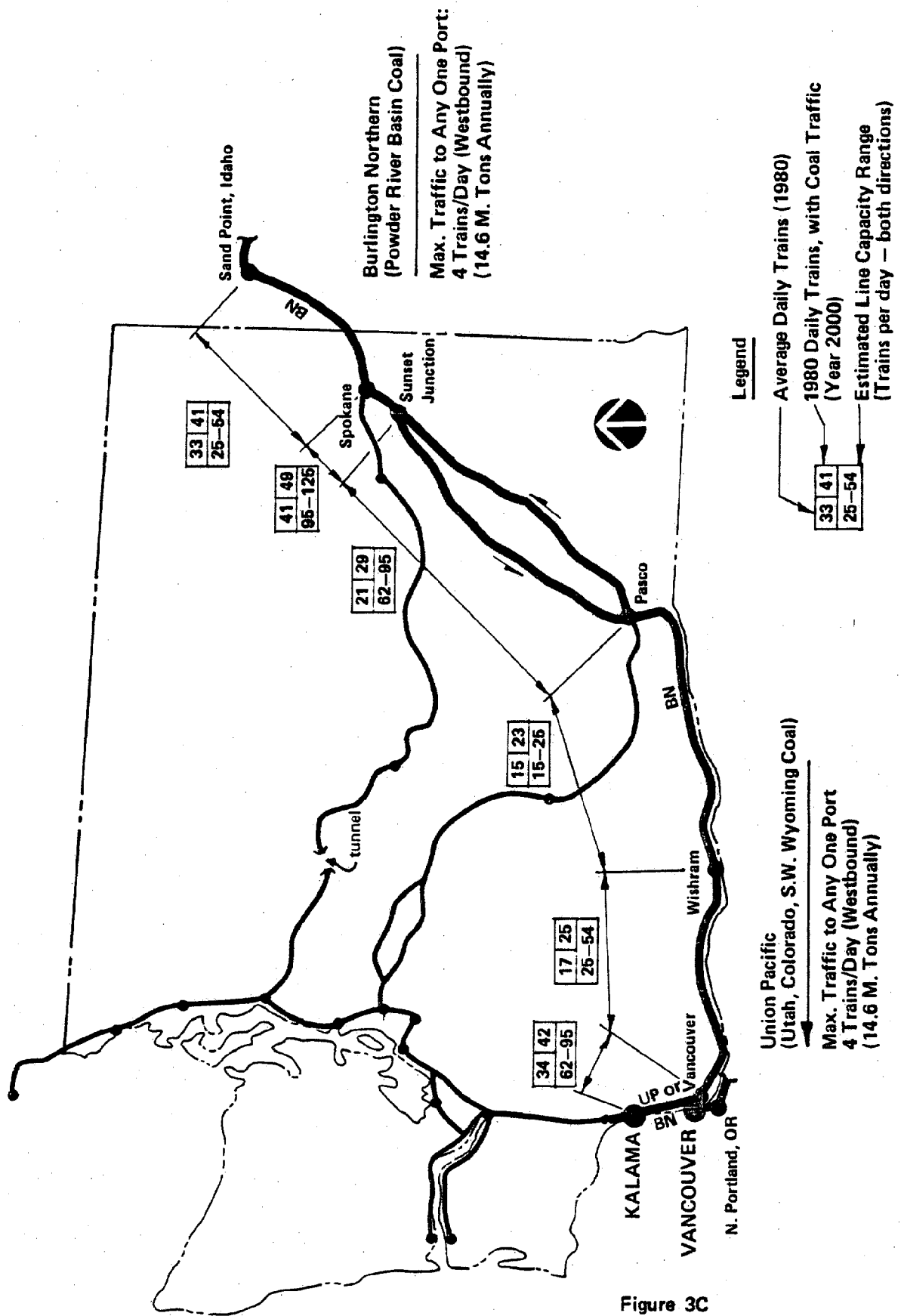


Figure 3C

Coal Train Traffic and Routes  
 Kalama/Vancouver Sites

Table 8 - Washington Communities on Principal Rail Routes

Port Site	Cherry Point	Anacortes	Tulalip	-----Steilacoom (Lone Star) -----			
Principal Rail Route	BN Stevens Pass Route	BN Stevens Pass Route	BN Stevens Pass Route	BN Stampede Pass/ Snoqualmie Pass Route(5)	UP Columbia River South Bank Route		
On-Line Communities	Ferndale BELLINGHAM Burlington MOUNTVERNON Stanwood EVERETT Marysville Stanwood EVERETT Snohomish Monroe Sultan Gold Bar Index Skykomish Dryden Cashmere Monitor WENATCHEE Quincy Ephrata Wilson Creek Odessa Harrington SPOKANE Millwood (Via Sand Point, Id)	Burlington MOUNTVERNON Stanwood Marysville EVERETT Snohomish Monroe Sultan Gold Bar Index Skykomish Dryden Cashmere Monitor WENATCHEE Quincy Ephrata Wilson Creek Odessa Harrington SPOKANE Millwood (Via Sand Point, Id)	Marysville EVERETT Snohomish Monroe Sultan Gold Bar Index skykomish Leavenworth Dryden Cashmere Monitor WENATCHEE Quincy Ephrata Soap Lake Wilson Creek Odessa Harrington SPOKANE Millwood (Via Sand Point, Id)	University Place Ruston TACOMA PUYALLUP Sumner AUBURN Ravensdale Palmer(1) Lester(1) Cedar Falls(2) Easton Cle Elum ELLENBURG Selah YAKIMA Union Gap Parker Wapato Toppenish Nabton Prosser KENNEWICK PASCO Kahlotus(3) Washlucna(3) Lamont(3) Mesa(4) Connell(4)	Hatton(4) Lind(4) Ritzville(4) Sprague(4) Cheney SPOKANE Millwood (Via Sand Point, Id)	Steilacoom Tenino Bucoda CENTRALIA Chehalis Napavine Winlock Vader Castle Rock KELSO Kalama Woodland Ridgefield VANCOUVER (Via N. Portland Oregon)	

NOTES:

1. Stampede Pass line, in service.
2. Snoqualmie Pass line, not in service. This former Milwaukee Road line to be improved when warranted by increased rail traffic.
3. Eastbound traffic between Pasco and Cheney.
4. Westbound traffic between Cheney and Pasco.
5. This is an alternate route.



Table 8 (Continued) - Washington Communities on Principal Rail Routes

-----Vancouver-----			
Port Site			
Principal Rail Route	BN Columbia River North Bank Route	UP Columbia River South Bank Route	
On-Line Communities	VANCOUVER Camas Washougal North Bonneville Stevenson White Salmon Bingen Lyle Wishram KENNEWICK PASCO Kahlotus(3) Washtucna(3)	Lamont(3) Mesa(4) Connel(4) Hatton(4) Lind(4) Ritzville(4) Sprague(4) Cheney SPOKANE Millwood (Via Sand Point, Id)	VANCOUVER (Via N. Portland, Oregon)

NOTES:

1. Stampede Pass line, in service.
2. Snoqualmie Pass line, not in service. This former Milwaukee Road line to be improved when warranted by increased rail traffic.
3. Eastbound traffic between Pasco and Cheney.
4. Westbound traffic between Cheney and Pasco.

#### Cherry Point Site

The Cherry Point site is served by a Burlington Northern branch line off the BN Everett-Vancouver, B.C. mainline at a point six miles north of Ferndale. The coal port site is located approximately seven miles west of the mainline. The branch line presently serves two petroleum refineries, one aluminum processing facility, and several smaller industries.

#### Anacortes

The port site is located on Burlington Northern's Anacortes branch line approximately 12 miles west of the BN Everett-Vancouver, B.C. mainline at Burlington. The Anacortes branch presently serves two petroleum refineries and two chemical plants located on March Point near Anacortes. At Swinomish Slough there is a swing bridge on the line which remains open to water traffic except during train movements.

#### Tulalip

The Tulalip site is located within the Tulalip Indian Reservation and is served by an existing branch line off the BN Everett-Vancouver, B.C. mainline north of Marysville. The proposed coal storage facility would be located in an area of relatively high ground accessible from the rail line. A conveyor system would transport coal to the dock site.

#### Steilacoom (Lone Star)

The Steilacoom coal port site is directly adjacent to the double-track Portland-Everett mainline of Burlington Northern. Union Pacific, which operates over this line between Portland and Tacoma, has direct access to the site.

#### Grays Harbor

The Burlington Northern and the Union Pacific maintain separate branch lines to Grays Harbor from the BN-UP Portland-Tacoma mainline at Centralia. Aberdeen is located approximately 57 rail miles west of Centralia, via both the BN and UP lines which are on the north and south sides of the Chehalis River respectively. The proposed coal port site is located on the south side of Grays Harbor, west of South Aberdeen on Burlington Northern's Markham branch line. The recently upgraded Union Pacific branch line provides a direct access route to the site, either via the existing interchange with BN's Markham branch at South Aberdeen or via a proposed relocation of this line south of South Aberdeen. Burlington Northern's access to the Markham branch line is via the Union Pacific bridge between Aberdeen and South Aberdeen. The route, however, requires reversing the direction of trains at both ends of the bridge to gain access to the proposed site from the BN line.

#### Kalama

The Kalama coal port site is directly adjacent to the double-track Portland-Everett mainline of the Burlington Northern. Union Pacific, which operates over this line between Portland and Tacoma, has direct access to the site.

## Vancouver

The Vancouver coal terminal site is located on a Burlington Northern spur line 1.5 miles west of a connection with the BN-UP Portland-Tacoma mainline. The existing track connection is from the south at the north end of the Columbia River bridge, enabling direct access to the site for unit trains routed via the UP through North Portland. Direct access for trains routed via the BN's Columbia River route would require installation of a crossing of the Portland-Tacoma mainline tracks to reach the BN spur track.

### Environmental Issues Associated with Rail Transport

The operation of unit trains to transport coal has an associated array of environmental impact concerns along prospective rail routes. Adverse impacts include delays at rail crossings, more rail/vehicle accidents, congestion, air quality problems, noise and environmental disruption.

Impacts to the physical and biological environments would primarily result from coal dust being blown from open train cars and from diesel exhaust emissions. This situation can lead directly to elevated levels of pollutants along portions of the route which could be of short-term significance in nonattainment areas. Longer term impacts might be realized where coal dust repeatedly settles in aquatic or terrestrial areas adjacent to rail tracks. Coal dust buildup could degrade local soils or impact nearby communities.

Generally speaking, a railroad right-of-way tends to fragment pre-existing habitat areas. However, since most coal traffic will probably utilize existing established tracks, this impact potential will likely be small.

Increased rail traffic due to unit train operation, could significantly impact the human environment, particularly where trains pass through populated areas. Congestion and safety problems arise at grade crossings heavily traveled by road vehicles. A mile-long unit train traveling at 20 miles per hour, for example, would occupy a grade crossing for about 3-1/2 minutes. Increased delays at rail crossings can disrupt communities along train routes. These delays range from inconvenience (the disruption of commuter traffic at rush hours) to potentially serious consequences, such as the delay of police, fire, ambulance and other emergency vehicles. Projected unit train traffic could also increase the likelihood of automobile accidents at rail crossings. Coal unit trains may also add to traffic congestion at rail junctions and cause significant delays to other port-related commodity traffic. At the Superior Midwest Energy Terminal (SMET) in Wisconsin, for example, unit coal trains cause two 9-minute delays of grain truck traffic for each coal delivery.

Noise impacts are a chronic problem with rail operations. Although most communities adjacent to rail corridors have adapted to train noise, a significant increase in rail traffic (and the use of larger engines for coal trains) could raise concern about noise impacts. Rail noise (approaching 100 decibels)(3) could exceed EPA and DOE guidelines for some areas.

---

3. At a reference distance of 100 feet

trains) could raise concern about noise impacts. Rail noise (approaching 100 decibels) (3) could exceed EPA and DOE guidelines for some areas.

### Slurry Pipeline

An alternative to the transportation of coal exclusively by train is the construction and operation of a coal slurry pipeline. This method of transport could be used to move coal from the mine to a port facility directly or to an inland storage area from which unit coal trains would make the final transport leg to specific ports. Figure 4 illustrates schematically the components of a slurry pipeline system. Although alternatives (such as oil or synthetic fuels) have been studied as potential slurry mediums, water is the typical carrier fluid.

The only proposed pipeline project for the northwest is the Northwest Integrated Coal Energy System (Gulf Interstate Snake River Pipeline). This project has a design capacity of 25 million tons of coal per year and would extend 1,100 miles from the Powder River Basin in Wyoming to northern Oregon.

The WESTPO study identifies four major issues associated with slurry pipeline development: rights-of-way and eminent domain; water requirements and conflicts; economic considerations; and environmental impacts. That study provides the following summary comments with regard to these issues.

- " o Eminent Domain: Because of railroad opposition, it will probably be necessary to have federal legislation granting the power of eminent domain.
- o Water Use: The major stumbling block to slurries in the West appears to be water--especially in the Northern Great Plains. Although water is a highly charged issue, on a regional scale sufficient unused water does exist to support significant levels of slurry pipeline development.
- o Economic Costs: In cases involving large coal volumes over long distances, coal slurry pipelines may be able to transport coal at a lower cost than railroads. However, an important issue of concern is the economic regulation of railroads (e.g., common carrier status) which does not apply to slurry pipelines.
- o Environmental Impacts: Railroads create greater environmental concerns than slurry pipelines because of noise and traffic safety in crossing many communities and highways. However, the environmental impacts for both modes are "acceptable" and thus do not provide a basis for choosing one mode over the other. "

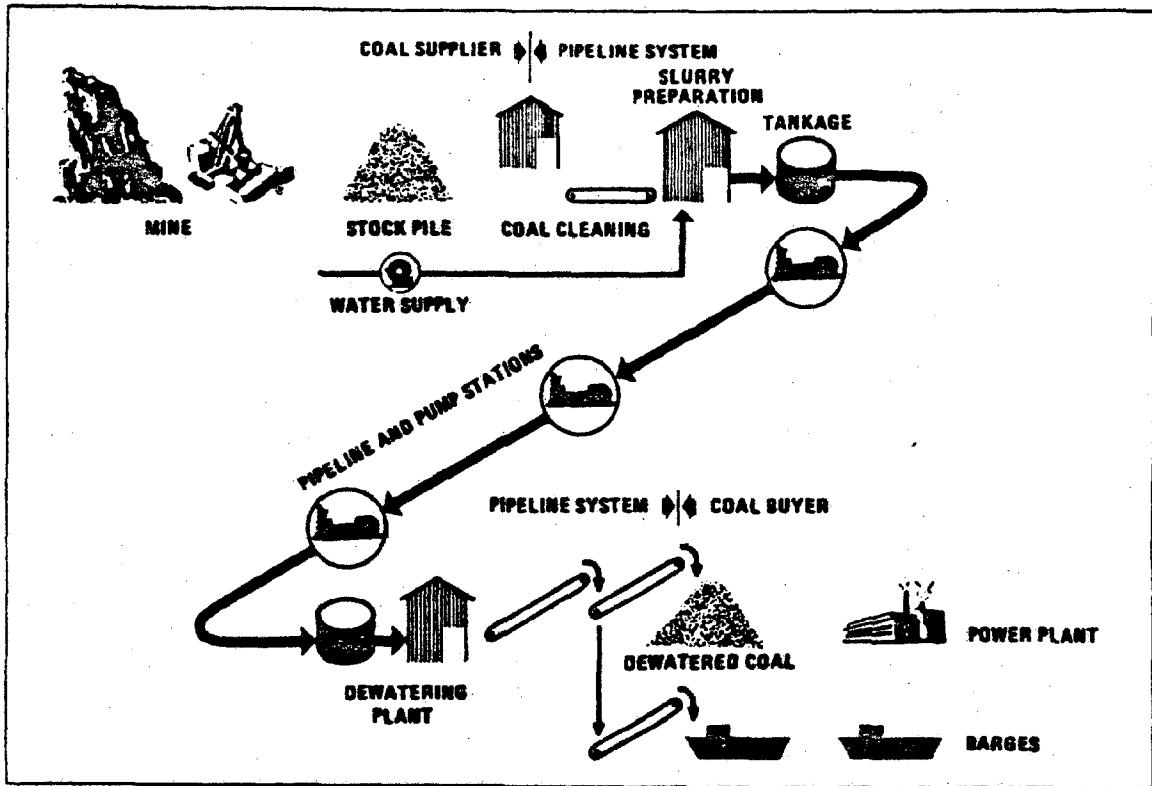
Major impacts resulting from slurry pipelines include construction-related activities as land surfaces are disrupted during excavation and pipeline burial activities. Operational impacts include the withdrawal of ground or

---

3. At a reference distance of 100 feet

Figure 4

SCHEMATIC OF SLURRY PIPELINE SYSTEM



Source: OTA, 1979

surface waters in areas with limited existing supplies and the discharge and dewatering of the coal slurry mix. Other operational impacts to ground and/or surface waters could result from pipeline plugging or rupture.

#### Barge Transportation

Movement of export coal by barge to northwest ports would likely have to be developed in conjunction with rail transport. Barge operations currently exist along the Columbia River and throughout Puget Sound. A rail link, however, would have to be established between the mine source and a barge transshipment area.

The disadvantages of barge transport include slow speed and inflexible routing. In addition, special unloading facilities are required, and loads are based on tow sizes which are limited by chamber size of locks in navigable waterways.

The real need for upgrading of the Bonneville Dam Locks is a major constraint to coal barge operation along the Columbia River (the area where barge traffic would potentially be the most practical).

The WESTPO study concludes:

"While barging is a potential mode of coal transport on the Columbia River east of Portland, it will probably not be activated until the late 1980's or 1990's, due to lack of cost competitiveness with rail haul."

#### IV. PORT FACILITY CAPACITY REQUIREMENTS

Utilizing Elements 1, 2, 5 and 6 of the basic methodology contained in the Port Handbook for Estimating Marine Terminal Cargo Handling Capability, U.S. Department of Commerce Maritime Administration (MarAd), 1979, graphs were prepared to reflect tabulated information on coal port facility components. These graphs (Figures 5 through 8) can be utilized to determine incremental facility requirements and to give a general indication of the impact certain mitigation measures may have on throughput capacity.

The graphs were used to develop facility component parameters for the generic facility plans presented in the next chapter. They are presented here as a useful guide for assessing component and facility capacities for any of a wide range of facility sizes.

It is not possible through the use of this procedure to determine the total number of new sites required to meet projected needs. This is due to the inability to predict the amount of total demand any single facility will be able to capture. However, based upon the market share analysis and the sizes of facilities currently proposed, the capacity requirement for the northwest (Washington state ports and Oregon ports along the Columbia River) is on the order of two to three coal port facilities by the year 2000.

The dashed lines on the graphs illustrate the method used to determine throughput for a Panamax-sized terminal. The four basic capacity components illustrated by the graphs are described in the MarAd publication as follows:

##### Component 1 - Ship Size and Frequency

Component 1 is the only component with two interrelated graphs. The left-hand graph relates annual visits, tons of cargo transferred per ship visit, and annual cargo throughput. The right-hand graph relates berth length and water depth to expected maximum ship size at that berth. The scales of the graphs are so constructed that the ship size can be projected across to a reference line on the left-hand graph to determine anticipated average ship load for a given maximum ship size. The user should be aware that the ship load is given for the average expected ship size corresponding to a maximum ship size since all the ships that visit a berth would not be expected to be maximum size.

The left-hand graph can be entered with any of three pieces of data: water depth, berth length, or ship size in dead weight tons. Any one of these will be sufficient to find the point on the ship size scale that represents the maximum expected ship size. If two or three pieces of information are given, the one that gives the least ship size value should be used and other values ignored. Once the appropriate ship size is found, a line may be projected directly across to the reference line of the left-hand graph. The right-hand edge of the left-hand graph serves as a reference line where the lines representing average cargo transferred per ship visit intersect at the same vertical distance as the corresponding maximum ship size on the adjoining graph. Any line from a point on the reference line to the origin of the left-hand graph will represent a value for tons of cargo transferred per ship visit that corresponds to a given maximum ship size. The annual cargo throughput

is obtained by first finding the point on the tons per ship visit line directly above the number of ship visits per year then projecting horizontally to the left to read the annual cargo throughput for Component 1.

The left-hand graph (annual ship visits and typical ship load) may be used alone if the correct data is known. Since the object of the investigation normally is to find the annual tonnage, unless the typical value is used, it is necessary to have data for both of the other two elements to get a throughput reading.

Whereas the graphs are designed for the use of people seeking an estimate of annual cargo throughput when other data is given, they could be used to find terminal operating information when annual throughput is either known (as in making an investigation of an existing terminal) or assumed for purposes of sizing various terminal elements. Any two elements will determine the third in every graph.

#### Component 2 - Ship/Apron Transfer Capability

Component 2 representing the ship/apron transfer operation, consists of a transfer unit, a rate of transfer and tons per unit time, and a time to work. Transfer units may vary for different modules and may be anything from a longshoreman gang to a pipeline. The transfer unit will be specified for each module but the specified unit may always be used in the real world.

To find the transfer unit hours per year, make the following calculation based on given data or the typical value. The value of any unknown element can be found when all the others are known: (average cargo transfers per ship visit times number of ships per year) times (number of units per ship times transfer rate in tons per hour) equals the unit hours per year.

Note that if the average cargo transferred per ship is multiplied by the number of ship visits per year the result is the annual cargo throughput. This holds true regardless of how long a ship waits for service.

#### Component 5 - Inland Transfer Processing

Component 5 represents the terminal's storage/inland transport cargo transfer capability. The transfer unit usually consists of a mobile unit such as a forklift, truck, crane, or ship loader, but could be a pipeline or conveyor belt. The annual cargo throughput capability is found by multiplying the transfer unit's rate of transfer in tons per hour by the number of units available or needed times the period units are working. This relationship is expressed as follows:

$$\frac{(\text{number of transfer units}) \times (\text{transfer rate})}{(\text{hours worked per year})} = \text{annual cargo throughput}$$

If the user knows any three of the four factors he can find the fourth. To enter the chart with unit hours worked, two terms must be combined: hours worked and the number of units. Hours worked per year is a function of shipload in that a particular shipload must be cleared from

Figure 5

COMPONENT 1: SHIP SIZE AND FREQUENCY

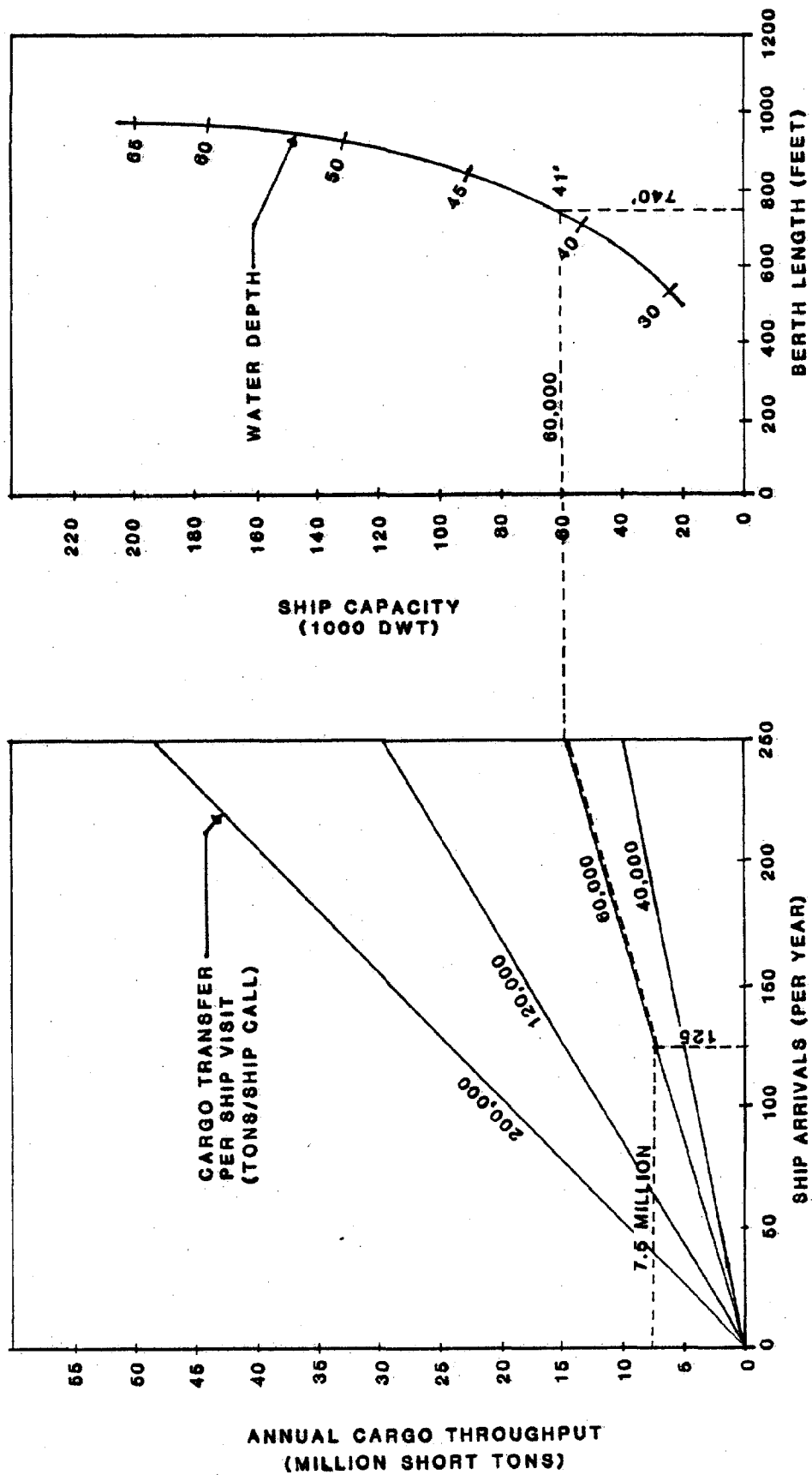


Figure 6

COMPONENT 2: SHIP/APRON TRANSFER CAPABILITY

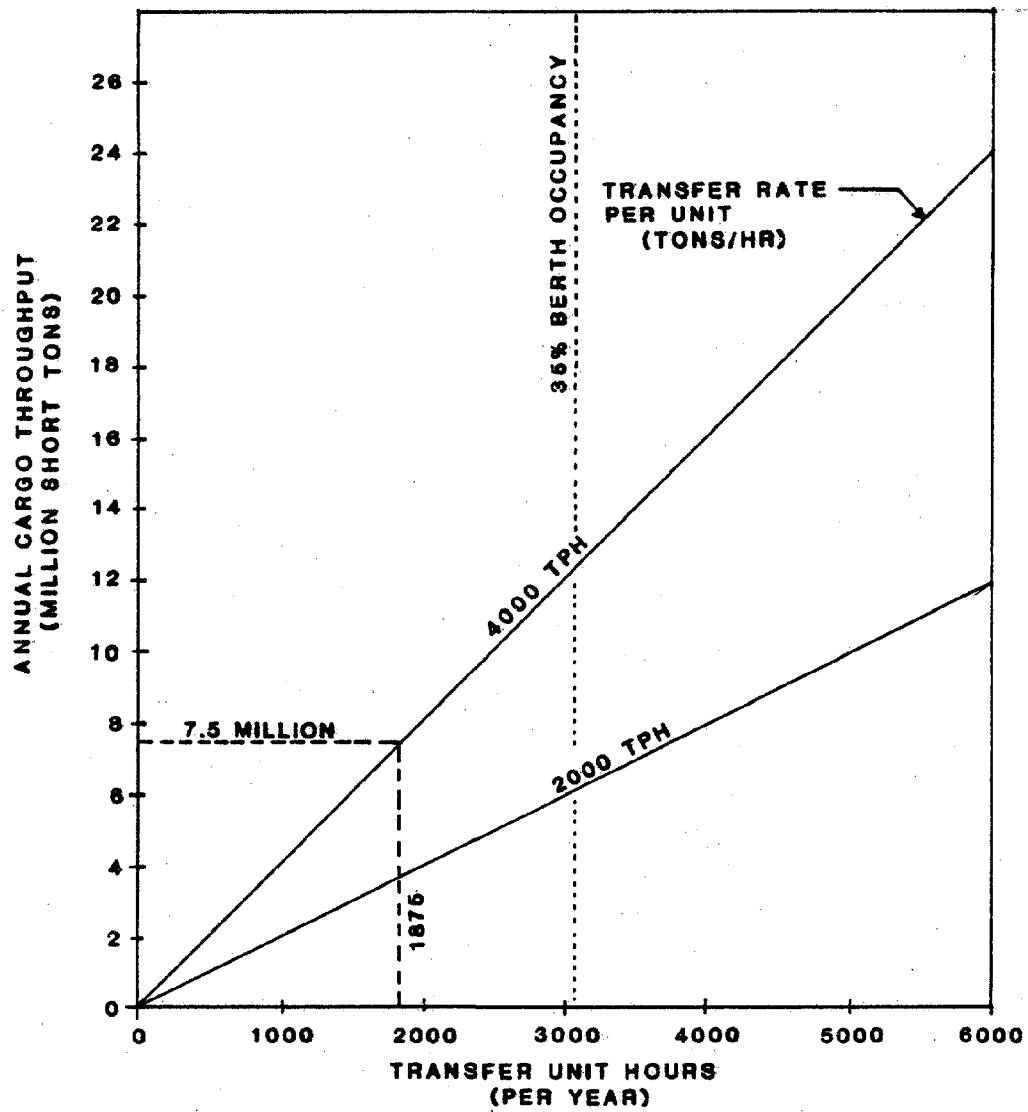


Figure 7

COMPONENT 5: INLAND TRANSFER PROCESSING

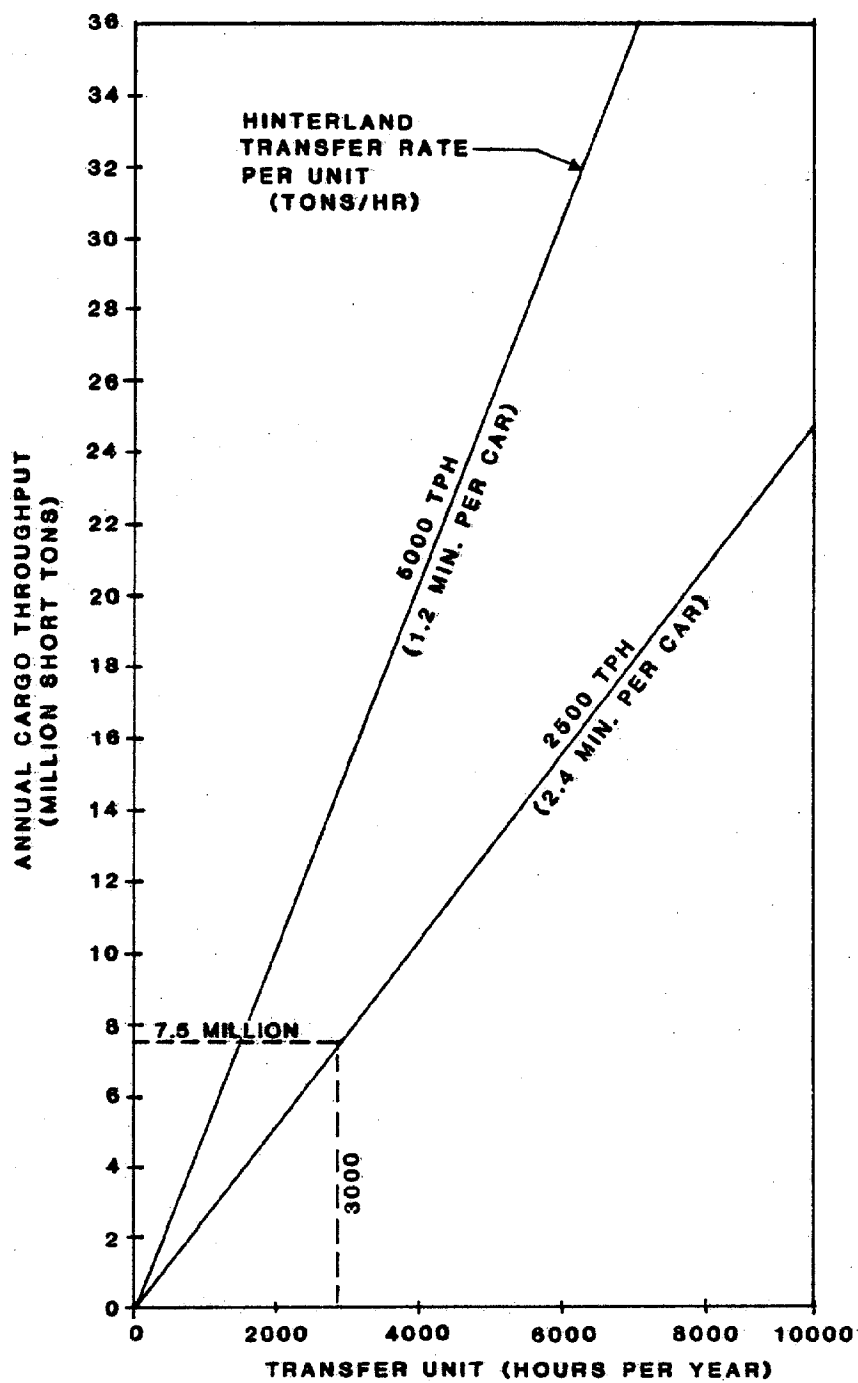
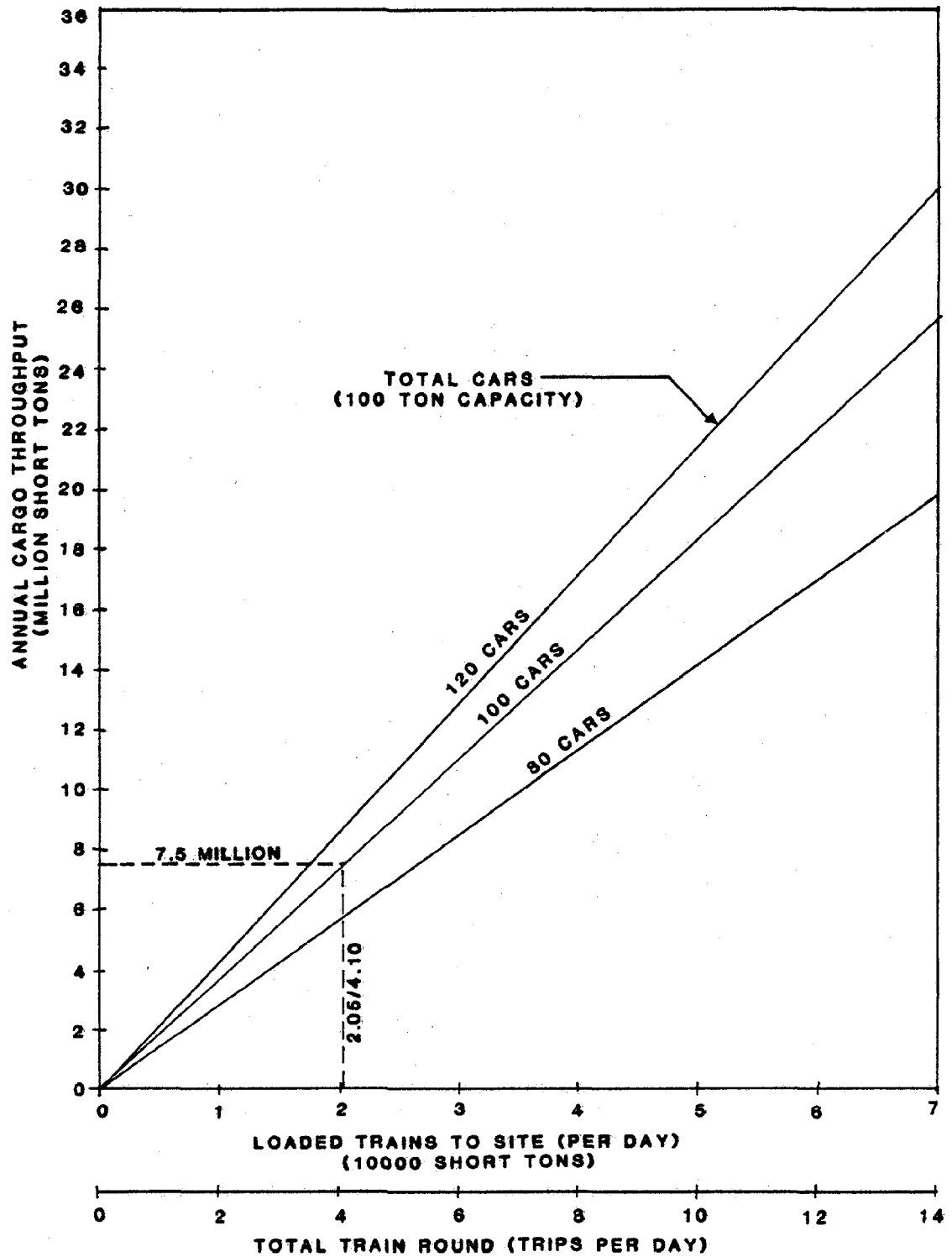


Figure 8

COMPONENT 6: INLAND TRANSPORT UNIT PROCESSING CAPABILITY



storage before the next shipload is brought in (neglecting, for the moment, storage). Transfer operations between storage and land-side transport are usually accomplished by working one 8-hour shift per day; that is, the normal shipload can be loaded into inland transport units by working one shift per day for a number of days not exceeding the interval between ship arrivals. Although a typical transfer rate per unit is given with the module, the user can enter the graph with any known rate.

#### Component 6 - Transport Unit Processing Capability

This component represents the capability of processing and/or moving inland transport units in and out of the terminal. Component 6 consists of a type of processor, a processing rate, and a number of processors. The processor can be a warehouseman, a gate tender, a rail car yard engine, or a traffic lane at the gate. For this study this graph was modified to use a loaded train (10,000 short tons) as the "inland transport unit," the number of loaded trains per day as the "processing rate," and the number of rail cars as the "number of processors." The processing rate of inland transport units is one of the basic measures of the capability of a terminal to throughput cargo.

The processing rate, multiplied by the cargo per inland transport unit, the number of processors and the time worked, will give the throughput capability of Component 6. This is expressed as follows:

$$\begin{aligned} &(\text{tons per transport unit}) \times (\text{processing rate}) \times \\ &(\text{number of processors}) \times (\text{time processors work}) = \\ &\text{annual cargo throughput.} \end{aligned}$$

Component 6 assumes that the unit load is known. Unit load is given for each module, and it represents the most probable mode and load for that type of cargo. If the user has other information regarding unit loads, he can prorate the throughput tonnage capability in direct ratio to the user data divided by the module data.

The user can enter the graph with any two of the three pieces of data to obtain the third, then modify the result by the unit load factor if necessary.

## V. PHYSICAL SITE REQUIREMENTS

### Facility Component Requirements

In basic terms, a coal terminal is a facility for moving coal from one method of transportation to another. For terminals now being planned for the Pacific Northwest, this transfer process will be accomplished through the use of six basic elements: an incoming rail line from the source of supply; a train unloading system (rotary dumper or hopper trestle); a weighing and sampling system at the loading and unloading points; a conveying system to move the coal from the unloader to the stockpiles and from the stockpiles to the ship; a storage area; and a berth or dock for ship loading (Figure 9). These various elements can be arranged in a variety of ways depending on such factors as land availability, soil, water depth, capacity requirements, terrain, and environmental considerations.

In order to arrive at an understanding of the impacts of a coal port terminal on the environment and how these impacts might be mitigated, it is necessary to determine total facility requirements needed to meet projected demand and to make a number of assumptions relating to the design of a "typical" coal port terminal. Table 9 outlines the basic assumptions used in establishing facility requirements and are arranged to illustrate two basic types of coal port terminals: the Panamax-size terminal, serving ships with a maximum draft of approximately 41 feet, and a terminal serving the larger vessels with drafts up to 65 feet. For the purpose of allowing direct comparisons, it is assumed that each terminal would have a single berth.

Basic design assumptions are outlined below and are used as a basis for projecting the environmental impacts discussed in Chapter VI. The various design components and/or assumptions outlined below are illustrated for each type of terminal in Figures 10 and 11. In addition, for the purpose of allowing direct comparisons, it is assumed that each terminal would have a single train unloader and berth.

#### Rail Access

Coal will be shipped to the site by rail using 100-car "unit trains" carrying approximately 10,000 tons, with each car holding approximately 100 tons. The total train length would be approximately 6,000 feet. Generally there are two types of rail cars that are utilized to haul coal. The first is the rotary-coupled cars which unload through the use of single or tandem rotary dumpers. These units have the capability of unloading approximately 2,500 tons or more of coal per hour. The second is the bottom dumper or "hopper" cars that unload from the bottom passing over a trestle unloading area. These units have the capacity of unloading nearly twice the coal per hour of the rotary-coupled cars. However, the bottom-dump cars are not able to haul as much coal per car weight as the rotary-coupled cars, thereby increasing rail transportation costs. The bottom-dump system is also more difficult to site, depending on existing grades.

TABLE 9  
COAL PORT CAPACITY REQUIREMENTS  
BASIC ASSUMPTIONS

<u>Type</u>	<u>Panamax Size</u>	<u>Larger Vessels</u>
<u>Ship Characteristics: Component No. 1*</u>		
Length, feet	740	960
Beam, feet	106	150
Draft, feet	41	65
Maximum size, DWT	60,000	200,000
Typical size, DWT	40,000	120,000
Typical shipload, one way, DWT	40,000	120,000
Typical cargo transfer, per visit, DWT	40,000	120,000
Typical time at berth, in hours	14.5 to 20.5	32 to 36
Interarrival time, in days	1.7 to 2.4	3.8 to 4.3
Vessel calls per year	150 to 210	85 to 95
Maximum percentage of time at berth	35	35
<u>Cargo Transfer at Apron: Component No. 2</u>		
Type of transfer unit	Conveyor belt	Conveyor belt
Number of berths/unit	1	1
Typical transfer rate per unit, TPH	4,000	4,000
Time to load ship (hours)	10	30
<u>Terminal Storage Capacity:</u>		
Gross background area, in acres	125 to 175	150 to 200
Storage area, in acres	50 to 75	75 to 100
Auxiliary area, in acres	75 to 100	75 to 100
Yard storage capacity, in million tons	0.5 to 1.0	1.0 to 1.5
Typical length of time per ton		
In storage, days	3	6
Throughput density, tons/sf/year	1.4	1.5
Storage type	Open	Open
<u>Inland Transfer Processing: Component No. 5</u>		
Type of transfer unit	Car loader/dump	Car loader/dump
Number of units	1	1
Transfer rate per unit, in tons per hour	2,500 to 5,000	2,500 to 5,000
<u>Inland Transport Unit Processing Capability: Component No. 6</u>		
Type of transport unit	Rail car	Rail car
Peak units per day	205 to 288	280 to 312
Time to unload transport unit, in minutes	1.2 to 2.4	1.2 to 2.4
Transport unit load, tons	100	100
Typical daily cargo, tons	25,000	25,000
<u>Throughput Capacity: (The following throughput capacity was derived from the above assumptions using the attached graphs.)</u>		
Yearly throughput capacity, million short tons	7.5 to 10.5	10.2 to 11.4

\*Note: MarAd components 3 and 4 are not applicable for coal ports.

Figure 9  
GENERAL FLOW SCHEMATIC

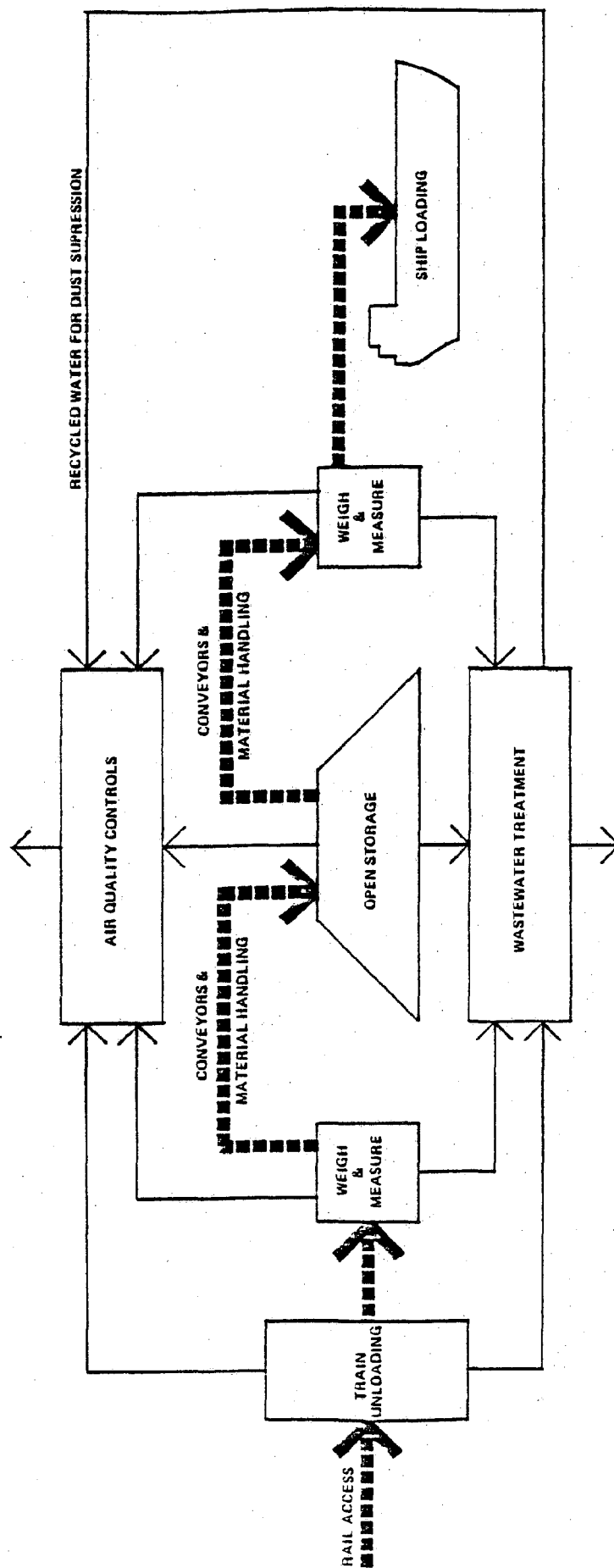


Figure 10  
SMALL PORT CONFIGURATION

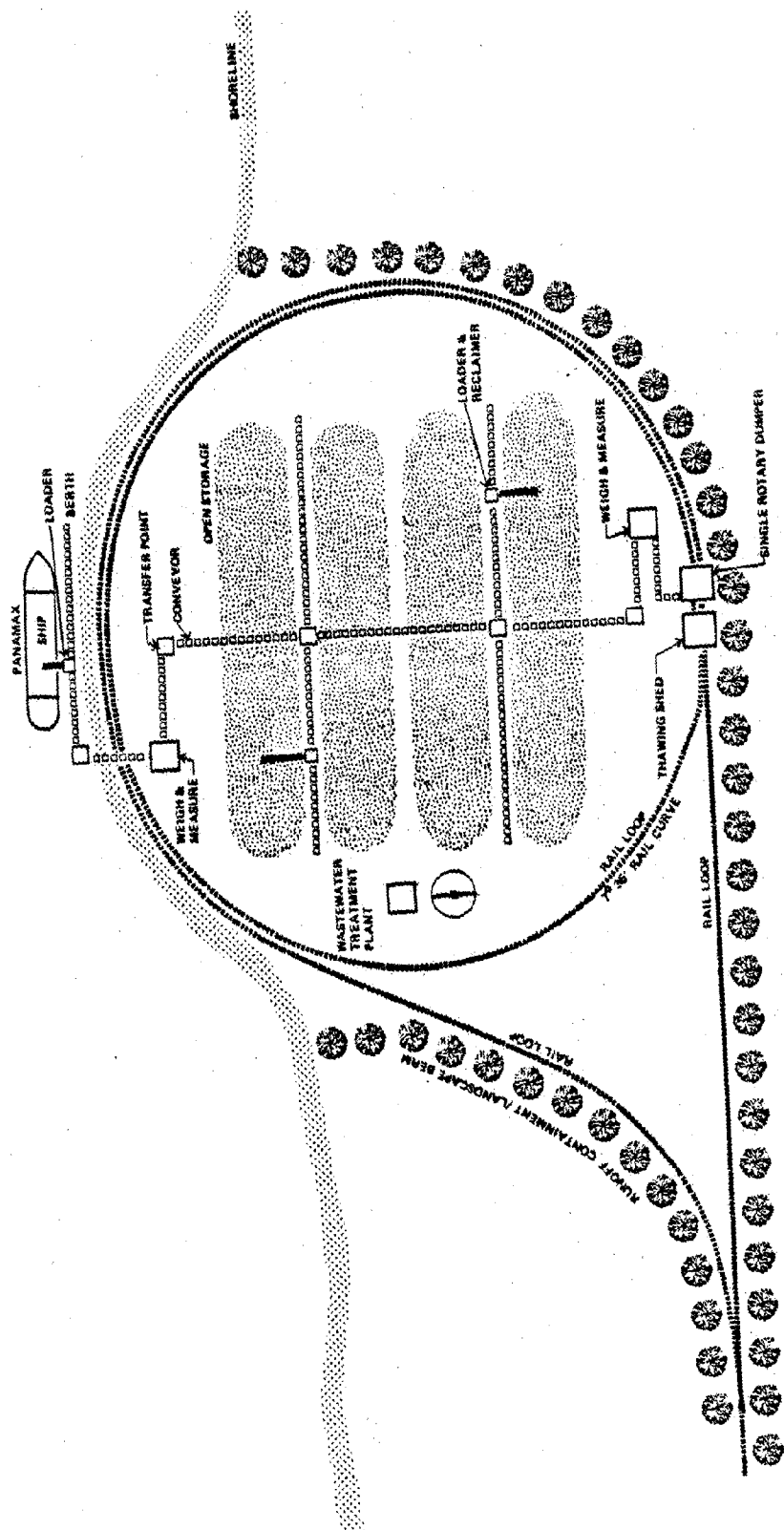
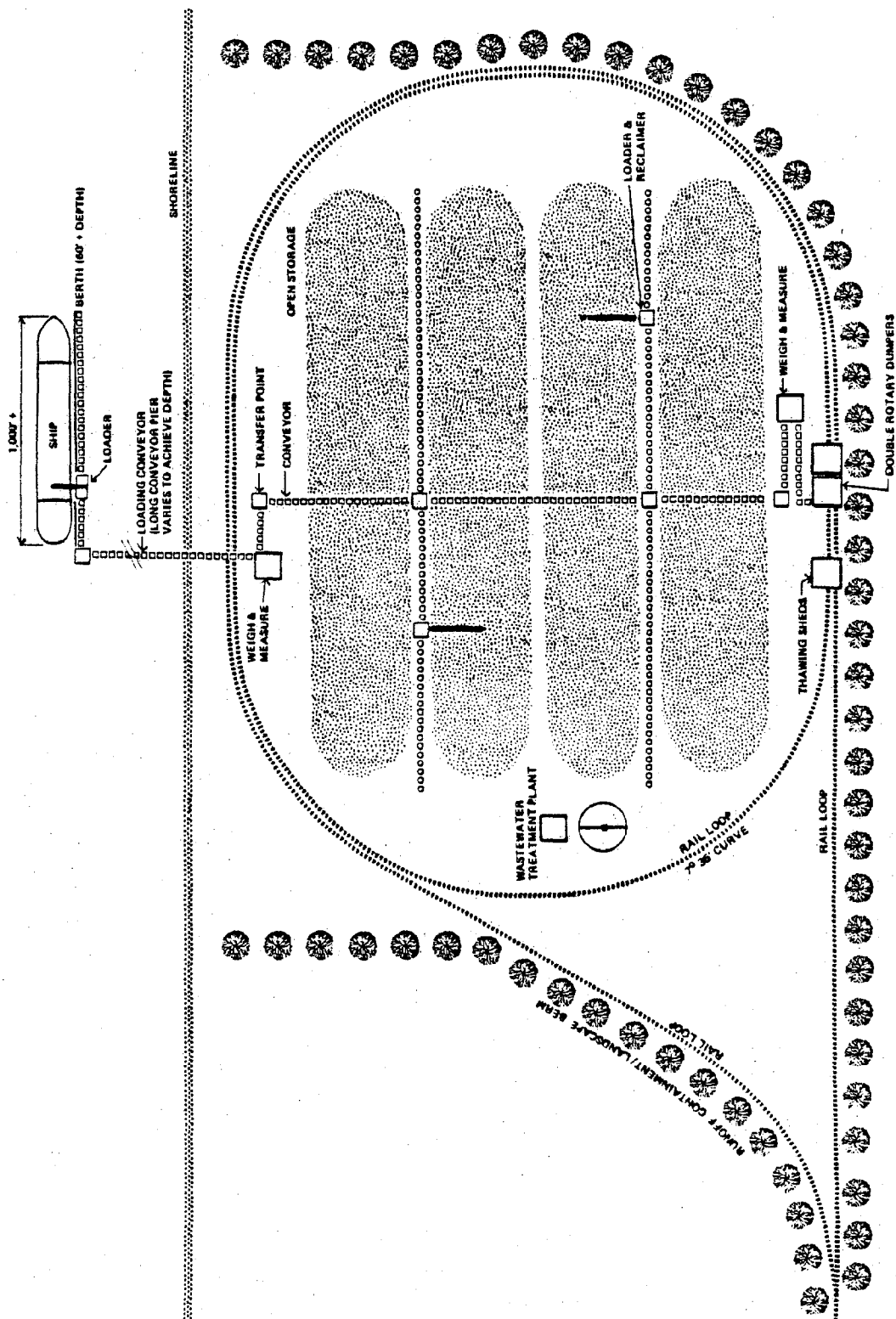


Figure 11  
LARGE PORT CONFIGURATION



There are basically two rail lines serving the study area; the Burlington Northern and the Union Pacific. Each of these two companies have specific design criteria for rail service to a coal port terminal. These criteria are similar for both companies. The terminal components assumed for this study are comprised of the most conservative criteria from each railroad. One of the most critical requirements relates to the length and curvature of the track because of the impact it has on overall acreage requirements. The most efficient and cost-effective way of moving the unit trains through the site is by utilizing a "loop" system of track with a minimum degree of curvature of 7 degrees, 32 minutes. This configuration requires approximately 80 to 100 acres of land. It is also desirable to have sufficient trackage ahead of the unloader to accommodate a train without blocking intersections in the event of equipment failure or scheduling delays.

#### Unloading Systems

The terminal model design incorporates a rotary-dumper having a total capacity of 2,500 tons per hour. This would allow the unloading of a 100-unit train in approximately 4 hours. Rotary-dump systems can be designed to have a greater capacity than 2,500 tons per hour but these would not be required for a single berth terminal. The rotary-dump would be housed in an enclosed structure and would utilize current dust suppression technology. It is assumed that the same type of unloading system would serve both the Panamax and the larger ship terminal.

#### Weighing and Sampling:

Weighing and sampling facilities measure total coal tonnage and such conditions as moisture and sulphur content. This is done at both the time coal is unloaded from the train and just prior to ship loading.

#### Conveyors/Material Handling

Once the coal is unloaded, weighed and sampled, it is transferred to the open stockpiles by a conveyor system. For the larger ship terminal this component of the system model is a fixed, high capacity conveyor system with conveyor lines serving each stockpile. The conveyors are relatively high speed (approximately 600 feet per minute) and are up to 92 inches wide (the 92-inch-wide belt system was assumed because it allows lower belt speeds and reduces spillage). The maximum height of this system is approximately 100 feet. This system model has the capability to move coal to any of the storage piles singly or together.

Coal being loaded on ships is conveyed by a second, separate conveyor system. This system utilizes a moveable bucket "reclaimer" on tracks. The reclaimer transfers the coal by a conveyor to a "linear loader" that runs parallel to the berth. This loader is capable of discharging at a rate of 4,000 tons per hour and has the capacity to serve both the Panamax and larger ship sizes. The loader, approximately 120 feet high, is the tallest structure on the site. (Although reclaim tunnels have been incorporated into some designs, lower maintenance costs have favored surface reclaimers.)

## Storage/Land Requirements

Storage on the site is in open piles approximately 65 to 80 feet high. The amount of storage, and/or the specific number of storage piles required, is related to the number of different classifications of coal that must be accommodated and the differential rate of incoming and outgoing product. The requirement for backlog capacity from either the supply side or distribution side of the terminal also has a large effect on storage capacity requirements. Storage capacity at the terminal, although it is a major factor in the design, is not necessarily a function of the throughput capacity of the terminal. The Panamax terminal model has approximately 30 acres of storage space with up to four piles 200 feet wide, 1,200 feet long, and 65 feet high. The larger ship terminal model has a 50-acre storage area with up to six piles 250 feet wide, 1,200 feet long and 65 feet high.

The total land area required for each of the assumed terminals is primarily a function of storage area and the area required for the loop track. The Panamax terminal requires a total land area of approximately 100 acres, and the larger ship terminal requires a total land area of approximately 150 acres.

## Berth

For both of the terminal models, a berth consists of a water area and a pier or mooring structure adjacent to the loading facilities of the terminal. The berth for the Panamax terminal would allow ships up to 740 feet long to tie up for loading. The berth is approximately 860 feet long, 100 feet wide and would have a minimum draft depth of 41 feet at lowest tide. The berth for the larger ship terminal would allow ships up to 1,000 feet long to tie up, is approximately 1,100 feet long and 150 feet wide, and would have a minimum depth of 65 feet at the lowest tide.

Both of the model coal port terminals also require numerous other service and support facilities such as administrative offices, employee areas, maintenance buildings, dust control systems, surface water treatment systems, parking and outdoor storage areas, access roads, and service facilities for the ships.

Other design elements that have been included in both model facilities include: shore protection (riprap); fencing; landscaping; moorage facilities; an access channel to the berth and a turning basin that would allow ships of both classes to utilize the terminal unrestricted; and necessary public utilities and services such as sewer, water, and power.

While it was necessary to make specific assumptions as a basis for the impact model, there are a large number of design alternatives. Each of these alternatives has certain advantages and disadvantages in terms of cost, operational efficiency and environmental impact. Below is a brief description of each of the design alternatives evaluated:

### o Straight Track

Eliminates the rail loop in favor of a straight track, or spur, for unloading. This requires trains to reverse direction once the unloading operation is complete.

- o Bottom Dumping

Utilizes bottom dumping gondola, or "hopper," cars which discharge on a trestle into a conveyor system. This permits trains to unload while moving, with almost twice the unloading capacity of the rotary-coupled dumper.

- o Slurry Pipeline

Utilizes a slurry pipeline in place of a rail system to bring coal to the terminal. This system requires additional facilities for dewatering the coal and wastewater treatment.

- o Enclosed Storage

Provides for covering the open stockpiles or would store coal in "silos."

- o Direct Ship Loading

Requires a direct ship loading from the train or pipeline.

- o Bottom Feed Conveyors

Utilizes a fixed "hopper" conveyor under each individual storage pile to collect and transfer the coal to the ship loader.

There are a number of other design alternatives that could be included, but the above-described reflect the range of impacts such alternatives have on the environment and are the most likely to be considered in any design for this region. Table 10 summarizes the significant advantages and disadvantages of each of these design alternatives.

TABLE 10  
COAL PORT DESIGN ALTERNATIVES

<u>ALTERNATIVE</u>	<u>KEY FACTORS</u>		
	<u>Initial Cost</u>	<u>Operational Cost</u>	<u>Environmental Impact</u>
Straight Track System	Lower site costs. Less land required.	Higher freight costs. More rail operational problems.	Less land required. More potential for train/traffic conflict.
Bottom Dumping	Lower site costs. Rail cars cost more.	Unloading difficulty. Siting problems in some locations. Low capacity to weight ratio.	Train uses more fuel to haul ton of coal. Noisier than rotary.
Slurry Pipeline	Higher site costs. Higher facility costs.	Lower transportation costs. Higher costs to dewater coal.	Greater potential for water quality impacts. Increased off-site impacts (see Chapter III).
Enclosed Storage	Higher site costs. Possibly less land required.	Higher maintenance costs. Less flexibility.	Less air pollution. Greater explosion risk. Possibly less land required. Less water quality problems.
Direct Ship Loading	Lower site costs. Less land required.	Less flexibility. Higher demurage. High rail costs. High operating costs. Reduced capacity.	Less land required. Increased train/traffic conflicts. Increased impacts during emergencies.
Bottom Feed Conveyors	Higher site costs.	Less flexibility. More maintenance difficulty. Lower operating cost.	Explosion potential. Less visual impact. Less air quality impacts.

#### Permit and Approval Requirements

##### Introduction

With the environmental movement of the late 1960s and early 1970s came a variety of legislative packages designed to identify and minimize the impacts proposed actions would have on the environment. At the national level, such legislation included the National Environmental Policy Act, and the Water Pollution Control Act which was later amended to the Clean Water Act and the Clean Air Act. Washington state, like many others, followed suit. It passed its own State Environmental Policy Act. The state environmental concern also spilled over into land use management with the Shorelines Management Act.

This legislation along with other acts at the federal, state, and local levels requires a myriad of permits to be obtained prior to the development of a coal export facility or any other project of a similar magnitude.

Table 11 shows a list of coal port permit requirements along with agency responsibilities and typical processing times. What this table does not show is the amount of preparation time required prior to or during permit submittal and processing. It is during this preparatory period that coordination and negotiation between developer and agencies takes place. This preparation process can significantly affect the amount of time required to procure any particular permit or approval. Figure 12 provides a more realistic critical path flow chart illustrating the relative amounts of time required to procure different permits. Those permits with the longer time lines indicate areas where a significant delay could potentially extend project scheduling.

This chapter discusses the requirements which must be met in order for these permits to be issued. The major focus is on the permits that are designed to limit the environmental impacts and which the issuing agencies have some degree of discretion in their administration. Some discussion is also included on those permits that are performance related and have set standards and criteria that must be satisfied prior to issuance.

#### Federal Permits

Two federal agencies have jurisdiction over projects affecting navigable waterways. The U.S. Army Corps of Engineers issues permits for works and structures under authority of Section 10 of the Rivers and Harbors Act of 1899. The Corps also issues permits under Section 404 (of the Clean Water Act) for fill material in wetlands. The Coast Guard administers permits for bridges and causeways affecting navigable waterways under Section 9 of the Rivers and Harbors Act. The Corps requests input from the Coast Guard on Section 10 permits to ensure the proposal does not adversely affect vessel safety through impacts to navigation channels or aids to navigation.

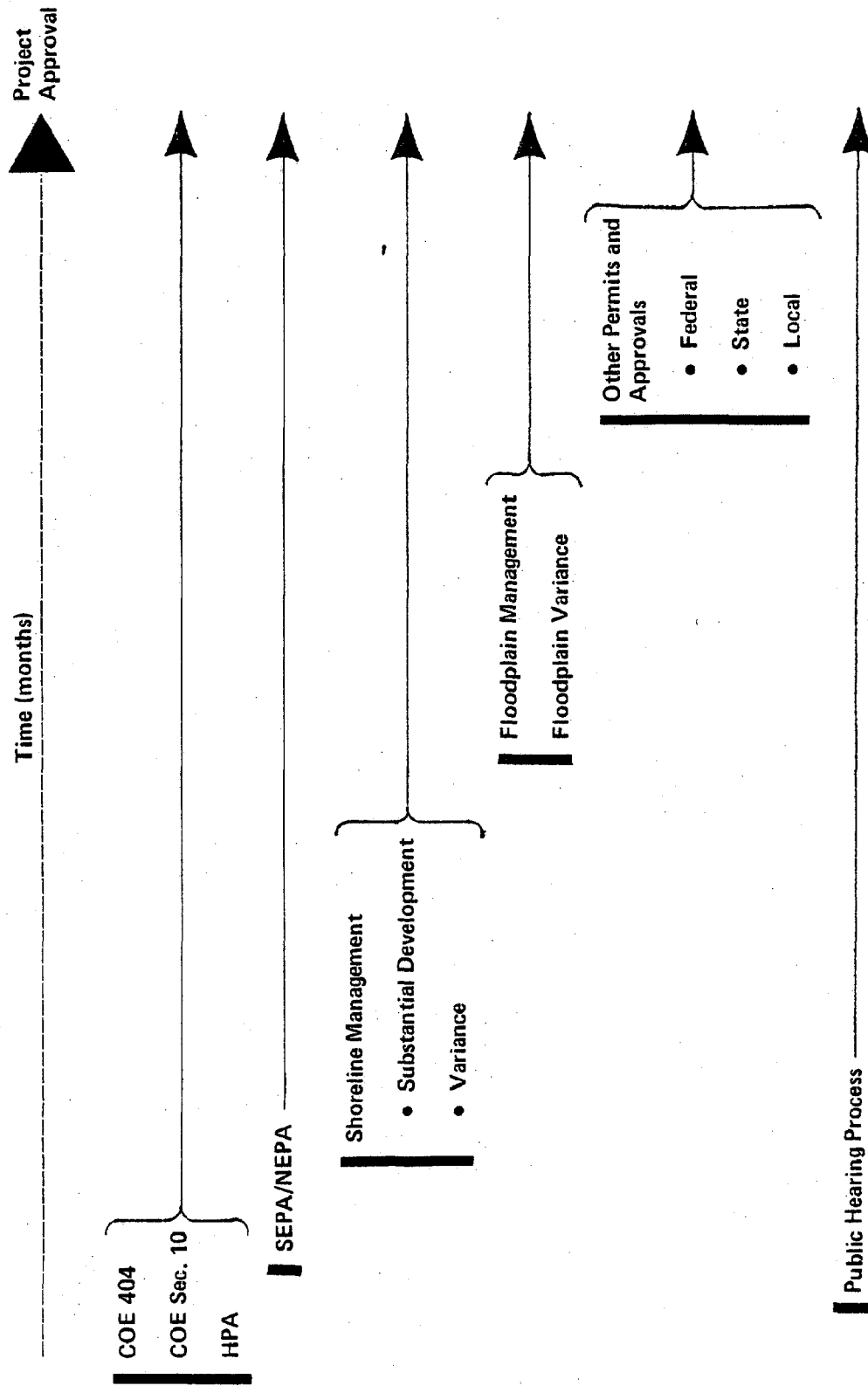
The Section 10 and 404 permits are highly discretionary and dependent upon input from a variety of federal, state, and local agencies. Such input usually comes in response to a "Notice of Application" issued by the Corps. By circulating notices of application, the Corps coordinates efforts and actions of all agencies with jurisdiction over a proposal to ensure its compliance with all regulations and interjurisdictional conflicts. Input from private individuals and groups is also solicited through the same mechanism.

TABLE 11  
Typical Coal Port Permit Requirements

Permit	Agency	Typical Processing Time
Corps of Engineers (COE)	Corps of Engineers	60-90 days
Hydraulic Project Approval (HPA)	Washington Department of Fish & Game	30 days
National Pollution Discharge Elimination System (NPDES)	Washington Department of Ecology (DOE)	5-9 months
Sewage and Waste Treatment Approval	DOE	2-6 months
Water Quality Certification	DOE	--
Short-Term Exception to Water Quality Certification	DOE	--
Water Right	DOE	--
Surface Mining Permit	DNR	25 days
Marine Land Lease	DNR	--
Deep-water Disposal Permit	DNR	--
Burning Notification	DNR	3 days
Air Pollution Control Facilities Approval	Regional Air Pollution Control Authority	30 days
Master Application	County Planning Dept.	--
Shoreline Management Act Substantial Development	County Planning Dept.	90 days
Shoreline Variance/Conditional Use	County Planning Dept./DOE	90 days
Floodplain Management and Supplement	County Planning Dept./DOE	15 working days
Floodplain Variance	County Planning Dept.	15 working days
Surface Mine and Supplement	County Planning Dept.	--
DSHS Approval	Department of Social and Health Services (DSHS)	--
Dredge Waste Disposal	DNR	--

Figure 12

Critical Path — Permit Preparation and Processing



There are two other external sources of input to the Corps that generally must be satisfied prior to the issuance of the Section 10 or 404 permits. One is the issuance of other permits by other agencies with jurisdiction. Hydraulics Projects Approval issued jointly by the Washington Department of Fisheries and Game is such a permit paralleling Section 10 requirements. Water Quality Certification by the Washington Department of Ecology parallels the Section 404 criteria. These permits will be discussed in detail later. The other criterion is agreement by the appropriate agencies that the project's impacts to the natural environment are mitigated.

The requirements of Section 404 of the Clean Water Act state that filling activities causing unacceptable impacts to wetlands associated with waters of the U.S. must be mitigated. Those agencies with responsibility for providing comments to the Corps are the U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), and the Washington Departments of Fisheries and Game (WDF and WDG). The variables and impacts of any proposed project are bound to differ from other projects. For this reason, there are few design criteria that can be applied to each and every project requiring resource agency review. Therefore, an applicant should contact each agency for input. Each proposal must be evaluated on its own merits for its adverse impacts to the wildlife and fishery habitat. Mitigating measures may then be developed to compensate for the adverse impacts peculiar to the proposal.

#### State Permits

There are a variety of permits issued by state agencies that would probably be required for the development of a coal export facility regardless of the location. Most are performance oriented. That is, there are certain criteria established by law that must be satisfied before the permit will be issued. This section will discuss each of these permits, the responsible agency, and the general requirements of each permit.

##### o Hydraulics Project Approval (HPA)

This "permit" is required for any project that involves dredging or the placement of a structure in state waters. R.C.W. 75.20.100 states that applicants must submit "full plans and specifications of the proposed construction work, complete plans and specifications for the protection of fish life in connection therewith..." and must receive written approval for the proposed project.

The restrictions placed on the proposal usually limit the types of materials used in construction of the structures, the period of construction and perhaps the method of construction. Dredging periods are confined to those times when juvenile fish of either food or game species are not present.

Dredging operations and procedures are also specified. This permit is issued jointly by the Department of Fisheries and Game. If wildlife habitat impact mitigation under the Corps' Section 404 permit and the Fish and Wildlife Coordination Act is involved in the proposal, an HPA will not be issued until the mitigation activity issue is resolved.

o National Pollution Discharge Elimination System Permit (NPDES).

This permit is required under PL92-500, the Clean Water Act, for any effluent discharge into public or private waters. Originally administered by the Environmental Protection Agency, the NPDES is now issued by the State Department of Ecology. The permit applies to discharges from sanitary wastewater treatment plants as well as to effluent from industrial wastewater treatment plants or, in the case of coal transshipment facilities, from the treated runoff from coal storage piles. Current regulations indicate that the limiting design event would be the 10-year, 24-hour runoff. Specific effluent standards for coal pile runoff have not been adopted at this time. However, Table 12 shows the NPDES requirements for the Centralia Steam Plant which has considerable volumes of above-ground coal storage.

TABLE 12

Centralia Steam Plant NPDES Permit Requirements

REQUIRED TO REPORT (sample above and below outfall as well as effluent)	LIMITS
Turbidity	75 NTU maximum and not more than 5 NTU above receiving water
pH	6.0 to 9.0
D.O.	6.5 mg/l or 70% of saturation, whichever is greater
Fe	Not to exceed 7.0 mg/l
Not required to report	Free of: 1. Oil or other petroleum products 2. Floatable or settleable solids 3. Toxic or deleterious material
Total suspended solids	50 mg/l*

\*Standards not in effect following the 10-year, 24-hour rainfall event.

- o Sewage and Waste Treatment Facilities Approval

This approval is issued by the Department of Ecology after it has reviewed the design and specifications of all wastewater treatment plants. The purpose of this approval is to ensure that the proposed treatment facility provides for a reliable and effective method of waste treatment, as well as to avoid the duplication of service where other facilities are available. In this manner, the number of effluent sources is limited. Obviously, this approval must work in harmony with the NPDES permit. Both the NPDES and Sewage and Waste Treatment Facility Approval require detailed engineering and design efforts and are not required during the initial site permitting phase. However, preliminary engineering evaluations are generally required during this phase by the Department of Ecology to ensure that the entire project is designed to minimize wastewater generation and maximize treatment capabilities.

- o Water Quality Certification and/or Short-Term Exception to Water Quality

This permit is issued by the Department of Ecology to ensure that there is no degradation of water quality during dredging activities or construction of structures in state waters. For the various types of dredging activities, methods of operation are specified for the dredge itself and for the water return. For structures, the types of materials allowed are specified. Short-term exceptions are granted when some impacts cannot be avoided, but DOE requires every effort to be made to minimize those impacts to water quality. This permit is required during the initial permitting phase and generally must be issued prior to issuance of the Corps' permits.

- o Marine Land Lease

Before development of mooring facilities can take place in state-owned waters, a lease for submerged lands must be issued. The power to lease all platted first- and second-class tidelands and harbor areas belonging to the state and situated upon tidal waters is vested in the Commissioner of Public Lands who supervises the Department of Natural Resources. Applications for leases of harbor areas upon tidal waters must be accompanied by drawings and plans of the proposed improvements. This lease application must be submitted to the Department of Natural Resources in acceptable detail prior to issuance of the Corps' Section 10 permit. Similar requirements exist for lease of freshwater harbor areas. Sites not on state owned lands are not required to obtain this kind of lease.

- o Air Pollution Control Facilities Approval

Any activated air pollution control authority may classify air contaminant sources which may cause or contribute to air pollution. The authority or Department of Ecology will require notice of construction, installation, or establishment of any new air contaminant sources. As a condition precedent to construction, either of those agencies may require the submission of plans,

specifications, and other information in order to determine whether the proposal will meet the requirements of all applicable air pollution rules and regulations and provide all known available and reasonable emission control. The applicant must show that the best available control technology will be used and that the facility will not result in a violation of state and federal air quality standards. In non-attainment areas, an emission offset would be required. If estimated emissions levels exceed 250 tons per year, pre-construction and operations monitoring may be required. If the agency determines the proposal complies, it will approve the proposal with possible conditions to assure maintenance of compliance. This approval must be obtained during the initial permitting phase.

o Water Rights and Approval of Public Water Supplies

Nearly any entity desiring to appropriate ground or surface water for a beneficial use shall first apply to the Department of Ecology for a permit for the appropriation. Each application specifies the source, the nature and amount of proposed use, the time the water is required, the location, and description of the works to deliver the water and the period of construction. All applications must include maps or drawings as the department may require. Water appropriations permits are necessary for withdrawal of water from any surface water body. Withdrawal from groundwater sources in volumes greater than 5,000 gallons per day requires an appropriation permit.

Either the local health district of the Department of Social and Health Services (DSHS) must approve the plans and the design of a public works to ensure that the facility will consistently and reliably provide water which meets potable standards. The agency with jurisdiction varies depending upon local health district capabilities and agreements with DSHS.

#### Local Permits

Most permits issued by local governments deal with the appropriateness of a proposal as a land use.

If the site proposed for a bulk handling facility is not designated for such use, either amendments to the zoning ordinance and comprehensive plan are required or a new site may be necessary. Procedures for amendments to these types of regulations vary from jurisdiction to jurisdiction. But, the proponent of an amendment can rest assured that a series of public hearings will be involved and that the proposed amendment should be thoroughly addressed in the project's environmental document for its public need, public benefits and detrimental impacts.

o Shoreline Substantial Development Permit

The Shorelines Management Act was enacted in 1971 as a measure to increase coordination in the management of the development of the fragile and valuable resources of shorelines. State guidelines, as administered through local Shorelines Master Programs, give preference to uses in the following order, which:

- o recognize and protect the statewide interest over local interest
- o preserve the natural character of the shoreline
- o result in long-term over short-term benefit
- o protect the resources and ecology of the shoreline
- o increase public access to publicly owned areas of shorelines
- o increase recreational opportunities for the public in the shoreline

No development may be undertaken on shorelines of state significance except those which are consistent with the state policy and local master program. Shoreline Substantial Development Permits must be obtained from the local agency with jurisdiction to ensure that the development meets the criteria of the Shorelines Act.

Permit application and issuance procedures vary among jurisdictions with the local master programs. Regulations that will be consistent though, are public notice procedures and review periods, compliance with the State Environmental Policy Act, and compliance with all other local land use regulations. Action by the local government to approve or deny the permits must be reported to the Department of Ecology for its review of the local action's conformance with state guidelines.

Appeals of local actions by aggrieved parties may be heard by the Shoreline Hearings Board. The appeal must be filed within 30 days of the Department of Ecology's receipt of the local action. The department or the Attorney General must certify the reasons for the review are valid before the matter goes to the Hearings Board. Judicial review of the local action or the Hearings Board's action may be an alternative.

Certain aspects of coal transshipment facilities may be designated as conditional uses or require variances under local Shorelines Master Programs. The purpose of a conditional use permit is to allow greater flexibility in the administration of the use regulations of the master program in a manner consistent with state policies. Conditional use permits may also be granted under circumstances where denial of the substantial development permit would

hinder the application of state policies. The purpose of variances is to grant relief to specific performance standards where there are unique or extraordinary circumstances relating to the property such that strict implementation of the regulation imposes a hardship on the applicant. Developers should consult local master programs to determine the need for conditional use or variance permit applications for potential sites. All variances, conditional uses, and Shoreline Master Program amendments require review and approval of the Department of Ecology.

- o Flood Plain Permits

Most local governments have adopted flood damage prevention ordinances as a means of avoiding damage to private property by flooding and to participate in the Federal Flood Insurance Program. These ordinances virtually prohibit development within the floodway or 100-year flood boundary unless the development can be proven to have no effect upon the elevation of the 100-year flood. Under certain circumstances, variances may be available. Additionally, development in the 100-year flood fringe usually is allowed by permit only. Standards for development in these areas require the project to be constructed above the 100-year flood elevation or "flood-proofed."

#### Other Permits

There are several other permits that may be required depending on the specific design of the facility and the site. At the state level, Burning Permits from DNR or the Air Pollution Control Authority may be required if there is vegetation to burn after the site is cleared. If there is mining to be performed, a Surface Mine Reclamation Approval from DNR will be necessary. The state Utility and Transportation Commission must approve all crossings of public roads and railroads. At the local level, all construction requires building permits. Also, some form of approval is usually necessary for the creation of new intersections between project roads and existing thoroughfares.

Although the state Department of Ecology promulgates specific noise standards (WAC 173-60) for development and commercial activity, no particular permit is required. Noise impacts must be addressed in the EIS for a site, however, where it must be shown that noise levels are either within state standards or are adequately mitigated.

Depending on local procedures, other permits or approvals may be necessary.

#### Summary

There are numerous permits and approvals that are necessary for almost all aspects of the development of a bulk coal transshipment facility. Working in concert with the mandatory environmental impact statement, these permits require the proponent to fully investigate and evaluate alternative designs and methods of development that will limit the adverse impacts to all segments of the environment. Through this process, the public interest is protected and maintained.

The permitting system is designed to be comprehensive in scope and coordinated among the various levels of jurisdiction. Those agencies with the closest and most specific jurisdiction must approve the proposal and issue the appropriate permit before the next level will act. In this manner, local permits must be issued prior to the state agencies issuing their permits. The federal permits are generally issued after all of the state and local permits are approved. This procedure is designed to avoid the possibility of conflict or contradiction among the various authorities.

## VI. ENVIRONMENTAL IMPACT POTENTIAL

### Introduction

Facility components and typical modes of operation, including transportational modes, are described in previous chapters. Given this background, a generic checklist of environmental impacts can be developed which can be used to make a first-order determination of major impact issues to be addressed at any particular site. This chapter presents an environmental checklist model utilizing supporting documentation of potential environmental impact. This model illustrates, in checklist fashion, both major and minor potential impact issues and provides the format for defining critical environmental issues on a site-specific basis in the next chapter of this document.

### Potential Impact Issues

Potential impact issues are those aspects of the physical, biological and socio-economic environments which could potentially be impacted either directly or indirectly by the development of a coal export facility at any particular location. Table 13 provides a synoptic breakdown of these potential issues organized in a checklist format similar to that described in the Washington State Environmental Policy Act (SEPA). The impact issues presented could be of either major or minor concern depending upon the character of a specific site. They are, however, presented here to provide a guide to environmental concerns which should be addressed in a detailed impact statement or assessment. The following text discusses potential environmental impact issues in detail.

#### Earth

Coal port facilities are characteristically surrounded by a berm structure to contain coal pile runoff and to serve as a rail bed for a loop spur track to accommodate coal unit trains. In addition, a substantial portion of the site area itself would be covered by a compacted clay or other impermeable layer to keep runoff from seeping into subsurface soils and groundwater. Coal piles, piers, dikes and roads are major facility components which impact earth conditions.

This type of excavation and development has the direct impact of changing area topography and compacting local soils at the site. Indirect impacts could result from modifications of established hydrologic regimes and runoff patterns in the area. In addition, pier structures across shorelines can change depositional patterns by interrupting longshore transport of sediments along a beach.

Table 13

CHECKLIST MODEL  
POTENTIAL IMPACTS

Earth

- o Changes to local topography
- o Surface compaction
- o Alteration of longshore transport

Air

- o Elevated dust emissions
- o Emissions from ships, trains and other vehicles

Water

- o Modification of hydrologic regimes
- o Elevated levels of runoff
- o Degradation of adjacent surface waters by windblown dust
- o Increased turbidity due to dredging and dredge disposal

Flora and Fauna

- o Degradation of adjacent wetland habitat
- o Degradation of adjacent aquatic habitat
- o Degradation of adjacent terrestrial habitat
- o Disruption of corridors and fish migratory pathways
- o Rare or endangered species impacts

Other

- o Noise pollution
- o Light and glare generation
- o Alteration of land use designations
- o Potential for onsite accidents
- o Potential for ship accidents
- o Traffic congestion at grade crossings
- o Increased demand for public services
- o Increased demand for utilities
- o Aesthetic impact
- o Disruption of recreational/commercial fishing
- o Disruption of general recreational activities
- o Archaeological/historical resource impacts
- o Competing uses for land and shoreline

## Air

The types of emission sources associated with a coal facility are fugitive in nature, similar to road and agricultural windblown dusts. The coal handling activities that will be potential sources of particulate emissions include: railcar unloading, conveyor belts, conveyor transfer points, stackers and reclaimers, shiploading points, and the storage piles. There will be secondary emissions (as products of combustion) associated with the facility from the exhausts of ships, trains, and vehicular equipment on site.

Fugitive dust is released from open storage piles by wind and other weathering forces. (Oxidation of stored coal may also result in some minor amounts of gaseous emissions.) Several factors influence the amount of particulate emissions from coal storage piles:

- o Weather conditions
- o Local topography
- o Coal pile surface area
- o Coal pile geometry
- o Moisture content and density of the coal
- o Length of storage time
- o Age of the coal
- o Coal size
- o Coal friability (dustiness)
- o Dust control design measures

The level of potential dust emissions from a coal port operation and the efficiency of dust control design measures was calculated for the proposed Port of Kalama site in Table 14.

The dispersion characteristics of potential coal dust from the proposed coal handling facility will be dependent upon weather conditions (wind velocity, precipitation), topographical barriers (embankments, dikes, vegetation), and the specific fallout characteristics of the dust particles. (The Port of Kalama (1982) estimated that for approximately 150 tons<sup>(1)</sup> per year of fugitive dust emissions, maximum main path fallout could amount to 0.022 pound/square foot/year). Studies conducted by the EPA<sup>(2)</sup> have shown that at wind speeds greater than 12 mph, only about 40 percent of the particulate matter would remain suspended at a downwind distance of 0.6 miles. The same studies have shown at a distance of six miles downwind less than 17 percent of the particulates were expected to remain in suspension. Of special

---

(1) This estimate for total particulate emissions may be low. Estimates for the Superior Midwest Energy Terminal in Wisconsin indicate that almost 1,000 tons of particulates were generated in 1980, for 4 million tons of annual coal throughput.

(2) L. Pelham and L.A. Abron-Robinson, M. Ramanathan and D. Zimmora, The Environmental Impact of Coal Transfer and Terminal Operations, EPA 600/7-80-169, October 1980.

TABLE 14  
SUMMARY OF POTENTIAL AND ACTUAL PARTICULATE EMISSIONS  
AT 15 MILLION TONS PER YEAR LOCATED AT KALAMA, WASHINGTON

	Emissions Factor*	Annual Capacity (million tons)	Annual Emissions (tons)	Control Efficiency (percent)	Actual Emissions (per unit)	Number of Units	Total Emissions
Railcar Unloading	0.4	15	3,000.00	99	30.00	1	30.00
Transfer Points	0.1	15	750.00	99	7.50	5**	35.00
Loading into Storage Piles	0.014	15	105.00	90	10.50	1	10.50
Wind Erosion from Storage Piles	0.020	1.5	15.00	90	1.50	1	1.50
Loading out from Storage Piles	0.017	15	127.50	70	38.25	---	38.25
Loading into Ships	0.4	5	1,000.00***	99	10.00	3	30.00
TOTAL							145.25

\* Expressed in pounds/tons calculated from EPA-450/3-77/010

\*\* Average

\*\*\* Annual emissions per pier

Source: Dennis, 1981

concern would be potential adverse impacts to nonattainment areas and other areas of air quality sensitivity located downwind of a prospective coal port operation.

Table 15 provides a rough estimate of the potential mass emission of other selected pollutants associated with one pound of fugitive coal dust from a site. These estimates were based on data reported by Cross, 1981 and Davis and Boegly, 1981, which have been adjusted to reflect coal dust emissions from western coal storage piles.

Visible emissions (other than from the ships, locomotives, and other mobile sources) should be minimal, and no measurable increase in odors should be detectable offsite.

There will be some impact on air quality during the construction of the proposed facility. Reasonable precautions should be expected to minimize the generation of dust and exhaust emissions by construction equipment.

Table 15

POTENTIAL POLLUTANT MASS CONCENTRATION  
IN FUGITIVE COAL DUST EMISSIONS

<u>Pollutant</u>	<u>Mass Concentration</u> <u>(parts per million by weight)</u>
Aluminum	8
Arsenic	7
Barium	65
Calcium	8
Cadmium	4
Chloride	160
Cobalt	9
Chromium	45
Cesium	2
Copper	30
Lead	7
Manganese	45
Potassium	2
Sodium	250
Iron	4

Water

Development of a coal port facility would probably modify existing patterns of surface water movement in an area. The major portion of a coal port site would be covered by a relatively impermeable working surface which could be expected to raise the runoff coefficient for the site area. Surface water and runoff would tend to move across the surface of facility working areas, accumulating in a system of ditches leading to a stormwater treatment system consisting of a series of settling ponds and several stages of treatment processes. After treatment, this water would typically be recycled for dust

suppression spraying of the coal piles. Excess treated runoff would probably be discharged to local receiving waters.

The potential contributor to water quality degradation in the area of a coal port development would be expected to result from fugitive coal dust emissions from exposed coal piles and from ship loading operations. Specific amounts of fugitive coal dust to be expected cannot be estimated until a determination is made regarding the "best available control technology" (BACT) to be incorporated into a specific facility design. This determination would be made during the permitting process administered by the local air pollution control authority.

Estimates of direct rainfall runoff from coal piles vary from 25 percent to 73 percent (U.S. Army Corps of Engineers, 1976; Cox, et al., 1979). Factors affecting the amount of rain as direct runoff include: frequency, intensity and duration of rainfall; pH of rain water; evaporation; and absorptive character of the coal.

Factors which affect the character of coal pile leachates include:

- o Coal pile volume, surface area and geometry
- o Coal particle size and absorptive character
- o Coal pile compaction
- o Rainfall
- o General climate
- o Degree of coal cleaning prior to delivery
- o Use of dust suppressant chemicals onsite

Specific water quality data for western coal leachate are limited. Most western coal mines have not been fully tested for pollution potential because these coals are considered basically "clean" (the sulfurs and various metals are primarily inert). However, Table 16 shows the expected range of pollutant considerations that could occur in coal leachate. These data were collected in August 1975 from the Kemmerer Coal Mines coal storage and handling facility located in southwestern Wyoming (Port of Kalama, 1982).

Table 16

## EXPECTED POLLUTANT CONCENTRATIONS IN COAL PILE LEACHATE

<u>Pollutant</u>	<u>Concentration (mg/l)</u>
Total Solids	500 to 3,000
Total Dissolved Solids	500 to 2,000
Total Suspended Solids	5 to 100
Total Hardness (CaCO <sub>3</sub> )	300 to 1,200
Alkalinity (CaCO <sub>3</sub> )	100 to 600
Bicarbonate	100 to 160
Sodium	20 to 200
Boron	0.7 to 0.8
Potassium	5 to 30
Calcium	120 to 240
Sulfate	100 to 1,000
Chloride	2 to 12
Fluoride	0.5 to 1.0
Silica	1.0 to 20.0
Manganese	30 to 150
Copper	0.1 to 1.0
Zinc	0.060 to 0.020
Aluminum	0.0 to 0.03
Lead	0.0 to 0.1
Total Iron	0.09 to 0.90
Ferrous Iron	0.0 to 0.5
Nitrate	0.3 to 2.3
TKN	0.7 to 3.0
Total Phosphate	0.4 to 1.8
Ammonia	0.4 to 1.8
BOD	1.0 to 3.0
COD	9 to 70
pH	6.0 to 8.3
Specific Conductivity	30 to 500 micro-ohms per cm
Dust Suppressants	Unknown
Bilge Discharge	Variable

The specific design requirements of an onsite treatment system are an issue that is determined during the "National Pollution Discharge Elimination System" (NPDES) permit application process. Specific EPA standards will have to be met for this kind of industry activity. Current regulations indicate that the limiting design event would be the 10-year, 24-hour runoff. Table 12 (in the previous chapter) outlines comparable permit requirements for the Centralia coal-fired steam plant.

Bilge water from coal colliers can adversely impact local water quality. Bilge water discharge must therefore be treated along with facility runoff at the onsite water treatment facility to avoid contamination of public waters. Some ports may require ships to treat bilge water on-board prior to docking and loading.

Dredging activities associated with coal port development temporarily increase turbidity in the adjacent navigable waters. Dredging may also be

required in areas away from the port site area (e.g., navigation channels, bars, etc.) in order to accommodate coal ship operations. Under these circumstances turbidity effects could be widespread. General issues associated with a dredging project include:

- o Water quality
- o Aquatic habitats
- o Population dynamics
- o Seasonal scheduling
- o Alteration of water flows
- o Migration routes
- o Dredge material disposal

Indirect or secondary impacts may result from constructed dikes and coal piles changing the course, velocities and heights of floodwaters in an area. Treatment of ballast water from arriving ships might also be an issue of concern. During summer months, the amount of water needed for dust suppression could reduce groundwater supplies in an area or affect public water availability. Contamination of groundwater by leachate seepage could also be a potential impact concern.

#### Flora

When physical aspects of a particular ecosystem are modified, biological parameters also change. Generally, the most far-reaching change is habitat removal and modification. Relationships between organisms and the physical environment which have evolved over many years change and cause new ecosystems to emerge that often are not as complex as the natural systems which were replaced. A loss of complexity in an ecosystem results in a decrease in the types of plants and animals inhabiting a particular area.

Of special interest is wetland habitat. However, a mixture of upland and aquatic vegetative habitat types which may exist at a prospective site may be a necessary condition to sustain local fish and wildlife populations and their habitat needs.

Floral habitats and issues of particular concern include:

- o Productive wetlands
- o Areas of diverse vegetative stands
- o Agricultural lands
- o Rare or endangered plant species
- o Unique or critical habitat areas

Other potential detrimental effects to vegetation in the vicinity of a coal port include clogging of stomata on plant leaves and impairment of photosynthetic activity by coal dust settling on plant structures.

In addition, heavy metals associated with coal dust might be taken up by plants and plant detritus and incorporated into their tissues. Potential mechanisms for this affect include:

Once incorporated into plant material, heavy metals can make their way into other branches of local food webs.

#### Fauna

All plant communities are utilized as habitat by a variety of wildlife species. Usually, the communities with a large diversity of plant structures harbor a large diversity of animals. The greater number of vegetation layers provides more habitat types for different animals to use. A coal facility constructed in a previously undeveloped area will eliminate wildlife roughly in proportion to the amount of habitat disturbed. Because it is likely other adjacent habitats are at maximum carrying capacity, displaced animals rarely survive when removed from their own areas and forced into new ones.

The use of pilings and piers for ship moorage should have little effect on bottom slope close to the shoreline. Consequently, shallow water habitat currently utilized by waterfowl, shorebirds, and some mammals should remain essentially intact.

Construction and operation of a coal facility could reduce the carrying capacity of pre-existing habitats bordering the site. Noise from the loading and unloading of coal, vehicle traffic, and many other human activities could disturb resident birds and other animals. Shipwash stranding of juvenile fish is a problem only seen when large ocean-going vessels travel at high speeds in constricted areas. This is known to occur along the Columbia River from the Grays River to Portland. Shipwash stranding occurs on beaches which have a slope flatter than one foot vertical to each eleven feet horizontal. Ship wakes from large ships have two effects. They erode and flatten sand beaches (such as disposal areas). The displacement waves from large ships also carry near-shore migrating and feeding salmonids up onto the beach. Return flow on a flat sandy beach is through the substrate, leaving the juveniles up on the sand. This effect occurs downstream of proposed coal port sites (on the Columbia River) where ships are moving rapidly while loaded. Compensation for this effect might include correction of flat stranding areas at the project site if they exist.

Dredging activities, associated with facility development and maintenance, can be a source of major impact to fisheries resources, as well as benthic communities, in an area. Aside from direct removal of sediment habitats, local depression of D.O. and sedimentation, dredging can interfere with fish (particularly salmonid) survival. Dredging is usually coordinated with State Department of Fisheries staff to avoid times of major salmonid migrations. Likewise, the placement of pilings is usually timed to avoid peak juvenile salmonid migrations minimizing disruption to fish from increases in turbidity and pile-driven shock during construction. Pilings, once in place, can potentially affect the schooling behavior of some fish, however.

The potential exists for some wind-blown coal dust to enter nearby aquatic habitats. Some of this dust will remain in suspension, while some will settle out and be incorporated into bottom sediments. (Tripp, et al., (1981) estimate that as much as 40 micrograms per gram of aromatic hydrocar-

bons found in some U.S. coastal sediments could be derived from unburned coal). The effect of coal dust on aquatic biota is not clear. Gerhart, et al., (1981) report increased mucous production in minnows which had digested coal dust. This affect quickly subsided, however, after the fish were reintroduced to clean water. It is probably safe to project that animals living in large, dynamic water bodies would probably experience no or only short-term adverse reactions to coal dust. Biota inhabiting constricted, slow-moving aquatic habitats could, on the other hand, suffer longer-term and more intense affects.

Other potential impact issues include creation of barriers to natural corridors of wildlife movement. The potential presence of rare or endangered animal species in a prospective site area is also an impact concern.

#### Noise

Noise levels will be increased at and near the facility by the following noise sources:

- o Increased railroad traffic
- o Railroad car unloading
- o Stackers/Reclaimers
- o Coal transfer operations
- o Shiploading operations

The noise sources, coming from various equipment types, will emit typical noise levels as determined from published information. These noise levels are summarized below:

	<u>Distance*</u>	<u>Noise Level (dBA)</u>
<u>Locomotive and Train Noise:</u>		
1. Locomotive engines	100 feet	74
2. Train cars--start/stop	100 feet	18
3. Train cars--wheel noise	100 feet	14
4. Train movement--in/out	100 feet	93**
<u>Facility Operation Noise:</u>		
1. Train unloading	50 feet	62
2. Conveyors	50 feet	63
3. Stacker	50 feet	63
4. 2 front-end loaders and 1 dozer	55 feet	71
5. Reclaim hopper loading	50 feet	78
6. Ship loading	50 feet	78
7. Baghouse fans	1 meter	85

\* Distance in feet from noise source that measurement was taken.

\*\* Short-term peak noise level.

Source: Morrison-Knudsen, 1982.

## Light and Glare

A typical coal port facility will be equipped with lights for nighttime operation. In addition, Coast Guard regulations will require the installation of appropriate aids to navigation, including navigational hazard lights.

A site located near residential or other nonindustrial areas will need to address the potential problem of disruption of adjacent communities by light and glare emanating from the site during nighttime operation. Isolated sites run the potential risk of adversely affecting wildlife usage of adjacent areas due to nighttime light and glare. Of particular concern is the potential for light and glare distracting passing motorists on adjacent roads and highways at night.

## Land Use

Site selection for a prospective coal facility should generally seek to comply with local comprehensive land use plans, zoning and shoreline management master programs. Where this is not possible, variances to existing land use designations may be required. Such variance requirements could have a variety of impacts depending upon adjacent land uses, agency concern and public receptiveness.

## Natural Resources

Fuel requirements for ship and train movements will result in the consumption of nonrenewable fossil fuels. In addition, the commitment of upland and shoreline land resources to this type of industrial use may be viewed as basically irreversible.

## Risk of Explosion or Hazardous Emissions

Some risk of accidental fuel spills will be present both during the receiving of incoming fuel supplies as well as during refueling activities for ships at port.

Various permitting and regulatory authorities, however, require environmental protection plans that will minimize spills or other potential harmful discharges into a river or shoreline. The Spill Prevention Control and Countermeasures (SPCC) plan, required by EPA for this kind of facility, will place several requirements on facility design and operational procedures, as well as placement of certain emergency equipment.

Coal pile fires can occur from sparks from machinery and tools and spontaneous combustion caused by the oxidation of metallic sulfides associated with the coal. The likelihood of spontaneous combustion is enhanced by the presence of moisture in a coal pile, a lack of air circulation and a large coal pile mass.

Some risk of coal dust explosion may be present if coal piles are covered or contained in silos.

## Population

Based upon projections for proposed coal facilities in Washington state, the creation of new jobs resulting in local population increases will not be a major impact. The Port of Kalama projects 135 new jobs at their 15-million ton per year facility (and 195 potential secondary jobs) with a resulting population increase to the area of 365 persons. The Ports of Vancouver and Grays Harbor estimate 30 and up to 121 direct jobs associated with their proposed 6-million ton and 10-million ton per year facilities, respectively.

## Housing

Given the relatively low level of facility employment, housing impacts are not anticipated to be a major issue.

## Transportation

Employee and operational traffic generated at a site is not expected to be a major impact issue.

Waterborne commerce and other traffic (including recreational and commercial fishing boats) could present some potential congestion and maneuverability problems depending upon the configuration of particular harbors and waterways and the number of other large ships operating in the area.

Coal will likely be delivered to local port facilities in unit trains of 80 to 110 cars, each car containing approximately 100 tons of coal. The length of a typical train is estimated at 6,000 feet. It is assumed that each train will bring approximately 10,000 tons to the site. For a 15 million ton-per-year site, this translates into approximately four or five round trips per day. This volume of traffic increase will present a variety of different impacts to communities along major rail transport routes, as well as to the coal port community. A detailed discussion of rail impacts is included in Chapter III.

## Public Services

Potential impacts to public services in a community are not anticipated to result in major adjustments to fire protection or police staffs, or expansion of local schools, parks or recreational facilities. Maintenance activities and other governmental services are not expected to be affected to any significant degree.

## Energy

No major energy requirements or source/availability problems should be anticipated.

## Utilities

Energy use at a prospective coal site should not be excessive. Based upon electrical usage at the Roberts Bank facility in Vancouver, British Columbia, electricity used per metric ton of coal handled is about 1.46 kWh.

#### Human Health

No major or unusual human health impacts are anticipated for people living near a coal port facility. The potential does exist, however, for health problems to develop in workers at the site. This is particularly true for personnel who work in confined areas where coal dust is prevalent. Respiratory ailments could result unless proper worker safety procedures are followed.

#### Aesthetics

A highly visible coal facility may result in significant aesthetic impacts, whether viewed from the land or the water. Coal piles are large and dirty, and considered by many to be just plain ugly. The prospective presence of a coal port can be extremely upsetting to adjacent land owners and users of an area who place a high premium on scenic country and shoreline vistas.

#### Recreation

Water associated components of a coal facility may present severe impacts to recreational fishing and other water uses in some areas, particularly where extensive pier or piling structures are required. Insurance carriers for a facility may require that recreational boaters and fishermen be kept away from these structures, thus excluding these areas from recreational use.

#### Archaeological/Historical

As with any major project, any suspected archaeological or historical resources in the development area must be surveyed and accounted for. An assessment of this kind of impact must be made on a case-by-case basis and coordinated through the state Office of Archaeology and Historic Preservation. A state-approved, professional archaeologist may have to be called to a site to conduct survey work prior to development.

#### Competing Uses

Competing potential uses for a specific site area may require a separation of facility components. For instance, unloading and storage operations which are not water dependent may have to be located well inland from the coal loading and ship berthing operations to allow more room for other competing facilities to utilize limited shoreline land resources.

#### Economic

The economic impact to a community of a coal port facility is generally to broaden the local tax base and increase local revenues. The diversifying influence of a coal facility on a local economy is often viewed as a means of alleviating existing economic hard times brought on by market slumps in more traditional industries like forest products. Coal ports also make available secondary industry and job opportunities which would not exist otherwise.

of alleviating existing economic hard times brought on by market slumps in more traditional industries like forest products. Coal ports also make available secondary industry and job opportunities which would not exist otherwise.

Taxes on a "typical" coal facility, valued at \$80 million (excluding land) with a throughput of 10 million-tons-per-year are identified in Table 17.

Table 17

POTENTIAL TAXES ON A COAL FACILITY

Construction

Sales Tax on \$80 Million Facility:

o State (\$4.5 cents/\$1.00)	\$3,600,000
o Local (1.0 cents/\$1.00)	800,000
o Total Sales Taxes During Construction	<u>\$4,400,000</u>

Annual Taxes

Sales Taxes on Goods and Services Purchased:  
(Assumes \$2,500,000 in supplies per year)

o State (\$4.5 cents/\$1.00) <sup>(1)</sup>	\$ 112,500
o Local (1.0 cents/\$1.00) <sup>(1)</sup>	<u>25,000</u>
o Total Annual Sales Taxes	137,500

Property Taxes on Improvements:

(Using typical rural Washington tax rates)

o Local (\$3.50/\$1,000)	\$ 280,000
o County (\$1.50/\$1,000)	120,000
o School District (\$200/\$1,000)	160,000
o State School (\$3.20/\$1,000)	256,000
o Other Districts (\$3.20/\$1,000)	<u>80,000</u>
o Total Property Taxes (\$11.20/\$1,000)	\$ 896,000

Total Annual Taxes: \$1,033,500

In addition, depending on land ownership at the coal port site, leasehold taxes or property taxes will also be paid to local governments. Property taxes are already being paid on undeveloped land, so no added taxes will accrue from coal port construction (assuming that coal port development will not increase the land's assessed valuation) on private land. Leasehold taxes on lands leased from ports or other governments could add another \$10

1. Sales tax rates assume the current state rate will revert to 4.5 cents in 1983 and that local governments will expand their taxing authority to the legal limit of 1.0 cents.

thousand to \$15 thousand per year in revenues to the state (based on a \$1 million land value with a 10% rate of return).

Another potential tax is the public utility tax of 1.8% of gross income, which will be assessed if a private developer uses port facilities for warehousing of coal. Since this is an unlikely occurrence, no revenues are estimated from the public utility tax.

State business and occupation (B&O) taxes will not be collected, because rail and water transportation are classified as interstate and foreign commerce. Transactions between coal buyers and sellers are thereby exempted from state taxes. The state inventory tax also will not apply to coal operations in this state, since it will be phased out in 1984.

To fund a large coal port facility, the ports themselves have several mechanisms at their disposal for generating capital. These include: operating revenues; tax levies; general obligation bonds; industrial development districts; and revenue bonds. According to a state Department of Commerce and Economic Development report (1980), the industrial revenue bond approach (e.g., the recently adopted HJR-7 approach) is probably the most logical public method of financing a coal port facility, since the leasee or user repays the bonds, not the public.

## VII. SITE-SPECIFIC EVALUATIONS

### Introduction

This chapter presents a first-order environmental assessment of specific potential coal port sites in Washington state. Included in this assessment are all port areas which have an expressed strong interest in developing a coal port facility.

Port areas identified in past studies include the following:

Cherry Point	Dupont
Anacortes	Grays Harbor
Everett	Longview
Tulalip	Kalama
Tacoma - main harbor	Vancouver
Steilacoom-Lone Star	

As a result of discussions with port officials and analysis of information available to this investigation only about half of these locations can be considered serious prospects. This is due primarily to a general softening of interest in response to recent reappraisals of potential current and near-term demand for U.S. coal. Ports previously interested in coal facility development cite the lack of a ready market for U.S. coal as one reason why they are no longer interested. Some ports perceive themselves as currently too far "out of the running" to successfully compete with those ports having permitted and approved sites.

The profiles included in this discussion deal with those port areas in the state still giving serious consideration to coal facility development. Each profile includes a synopsis of the proposed site setting, the current status of development plans and a general indication of major constraints as well as major opportunities related to coal port development. The profiles also include a checklist of potential environmental issues at each port area.

It is not the intention of this report to rank port areas with respect to their suitability for coal facility development. The evaluations are purely site specific and can only be appropriately used within the context of each specific site addressed. The evaluation of impact issues for each site seeks to distinguish those elements of the environment which have been or would probably have to be investigated in detail if a coal port project was seriously pursued. The evaluations are not environmental judgements on each site, but rather provide indications of those environmental issues of potential concern.

~ E.H.  
it  
was  
supposed  
to do  
this!

Figure 13 shows the locations of the specific ports profiled in this section.

### Cherry Point

Public Sponsor(s): Port of Bellingham  
Participants: Bellcoal Group (Glacier Park Co., subsidiary of BN Railroad; Anaconda Minerals, Inc., division of Arco Coal, Inc.; Bellingham Stevedoring Co., Inc.)  
Consultants: Swan-Wooster, Inc., Ertac, Inc.  
Principal  
Regulatory Agency: Whatcom County

Project Description: This facility would utilize a system similar to the "typical large ship" coal port designated earlier in this study. The site would contain approximately 200 acres, although approximately 1,500 acres could be made available for development if required. The upland site would contain open storage, train unloading, and related facilities. Ship loading and docking activities would occur in deep water (65-plus feet); served by a 2,000-plus-foot-long pier.

Location: The site is located at Cherry Point in Whatcom County, approximately 12 miles north of Bellingham. The deep water berth would be located approximately 2,000 feet out into the Straits of Georgia.

Capacity: The project is presently planned for a maximum capacity of approximately 14 million tons.

Setting: The proposed upland site is presently an open area with some mixed deciduous and evergreen trees. The surrounding area is rural in character with some small farms and residences abutting the property. Within the immediate vicinity there are two oil refineries (Arco and Mobil) and an aluminum smelting plant (Intalco). There are no designated wetlands that would be significantly altered by the upland portion of the development. No filling or dredging will be required to achieve deep water access.

Land Use Designations: The site and general area is planned and zoned for "heavy impact industry." The Whatcom County Shoreline Master plan designates the shoreline "conservancy," but allows the placement of piers and docks on pilings.

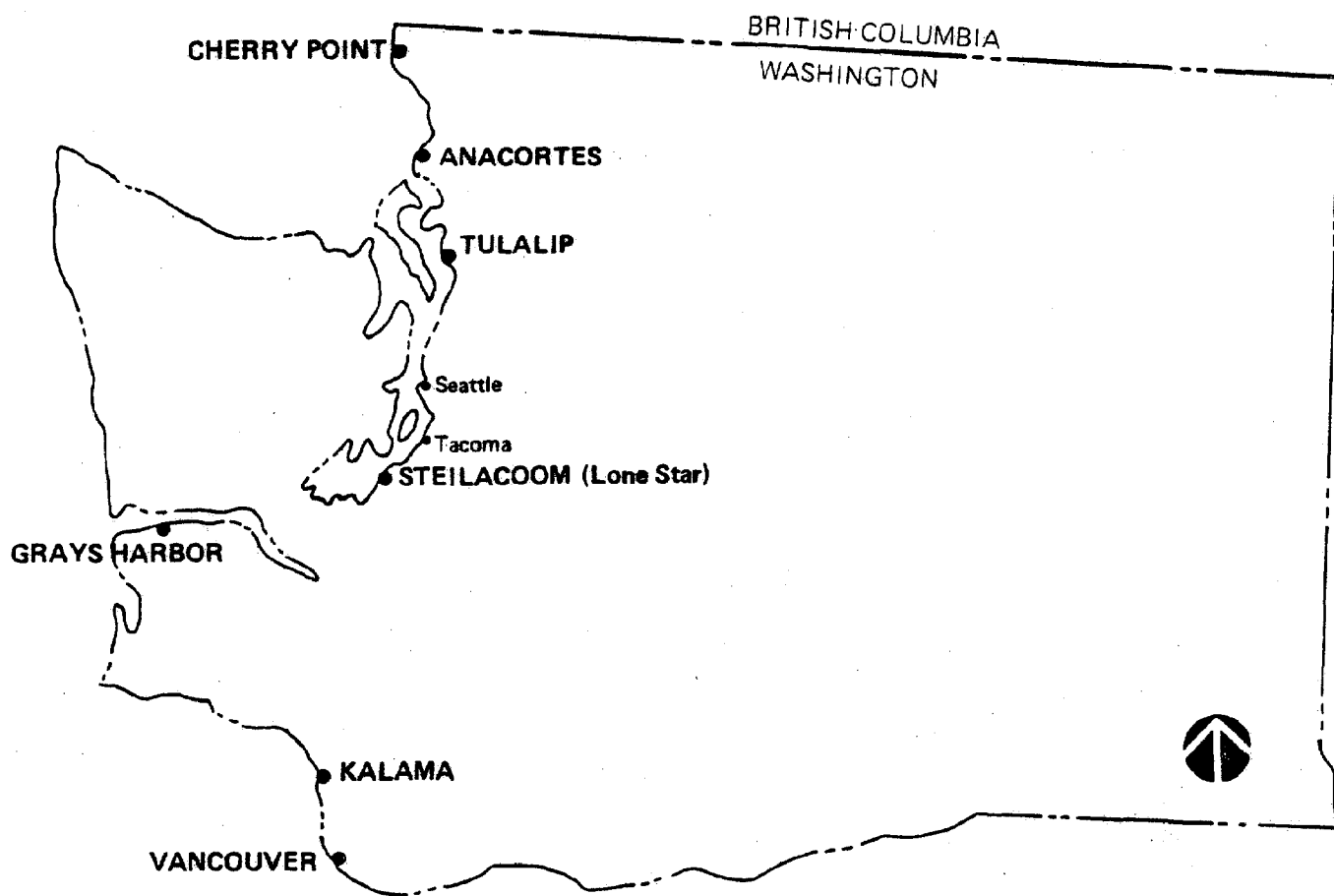
Public Facilities: The site is served by a public water supply that provides only processing water. Potable water would have to be processed or secured through the use of onsite wells. There is no public wastewater treatment facilities serving the site and all the industries in the area use onsite treatment facilities. Power will be provided by the Whatcom County PUD No. 1. The site would be served by the Burlington Northern Railroad over existing rail lines.

#### Constraints:

- o Train traffic will be routed through congested urban areas (Bellingham and Ferndale) with potential for grade crossing conflicts.

Figure 13

LOCATIONS OF SPECIFIC PORTS PROFILED



Cherry Point (continued)

- o There is a major recreational and residential area several miles "downwind" from the proposed site.
- o There are existing residences at least a mile from the proposed site.

Opportunities:

- o The site is located in an area planned for "heavy impact industry."
- o There are existing heavy industrial uses in the immediate vicinity.
- o The site has access to deep water.
- o Available adjacent area exists for other compatible land uses.

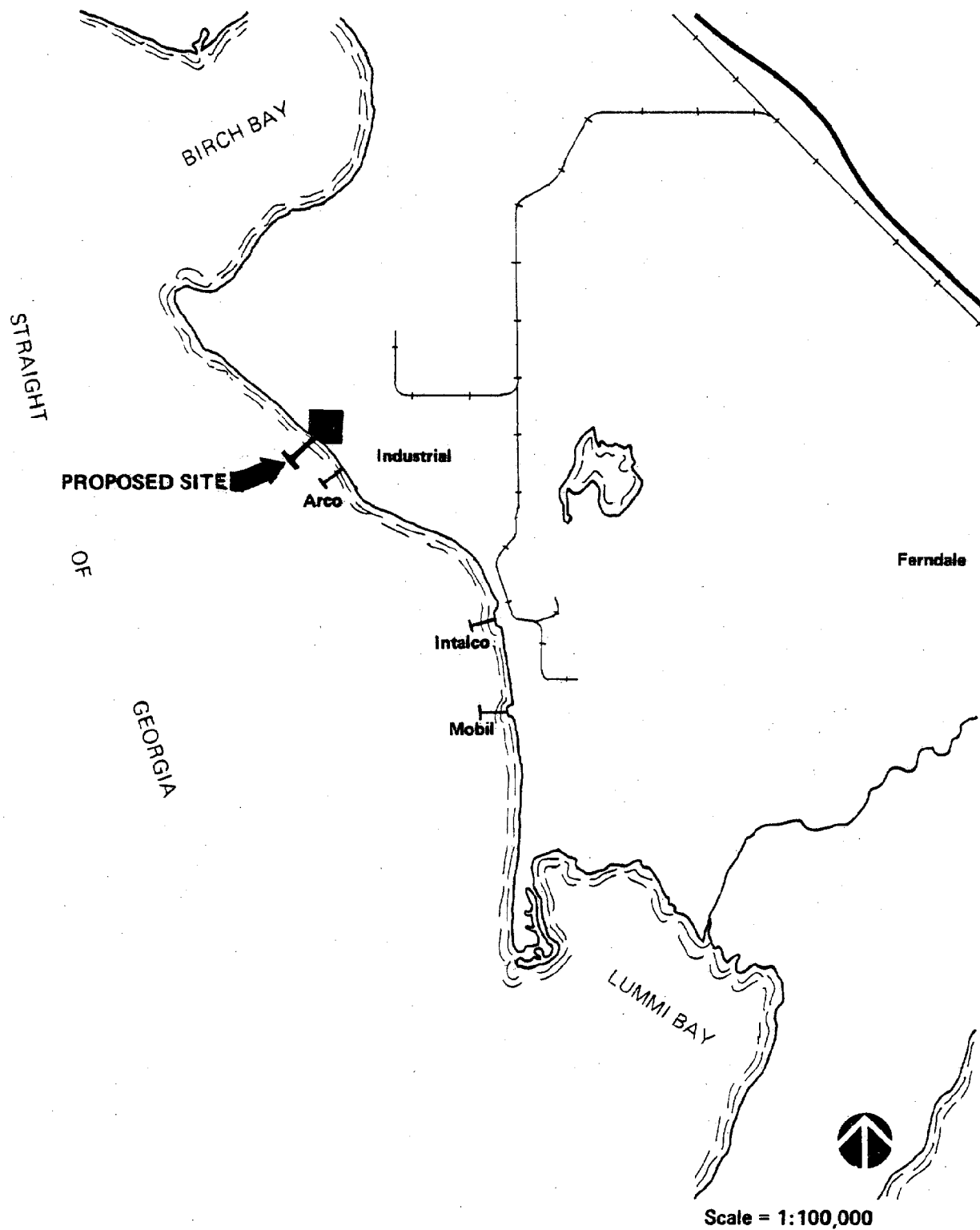


Figure 14  
CHERRY POINT TERMINAL SITE

# CHERRY POINT EVALUATION OF IMPACT ISSUES

Impact Categories	Potential Impact Issues	Minor or Non-Issues
<b>Earth</b>		
Changes to local topography		●
Surface compaction	●	
Alteration of longshore transport	●	
<b>Air</b>		
Elevated dust emissions	●	
Emissions from ships, trains and other vehicles	●	
<b>Water</b>		
Modification of hydrologic regimes	●	
Elevated levels of runoff	●	
Degradation of adjacent surface waters by windblown dust	●	
Increased turbidity due to dredging /disposal		●
<b>Flora and Fauna</b>		
Degradation of adjacent wetland habitat		●
Degradation of adjacent aquatic habitat	●	
Degradation of adjacent terrestrial habitat	●	
Disruption of corridors and fish migratory pathways	●	
Rare or endangered species impacts		●
<b>Other</b>		
Noise pollution	●	
Light and glare generation	●	
Alteration of land use designations		●
Potential for onsite accidents	●	
Potential for ship accidents	●	
Traffic congestion at grade crossings	●	
Increased demand for public services	●	
Increased demand for utilities	●	
Aesthetic impact		●
Disruption of recreational/commercial fishing	●	
Disruption of general recreational activities		●
Archaeological/historical resource impacts	●	
Competing uses for land and shoreline		●

## Anacortes

Public Sponsor(s): Port of Anacortes  
Participants: None Defined  
Consultants: None Defined  
Principal  
Regulatory Agency: Skagit County

Project Description: No project has been defined to date.

Location: The Port of Anacortes has tentatively designated the northeast end of March Point for coal port development. A specific upland site will not be defined unless a private developer is located. Ship loading would occur in deep water (60-plus feet) approximately 3,000 feet north of March Point in Guemes Channel. No filling or dredging would be required to achieve deep water access.

Capacity: Total capacity could be approximately 15 million to 30 million tons per year.

Setting: The east side of March Point is presently rural in character and is being used for residential purposes. There are no wetlands or designated unique or endangered species within this upland area. The west side of the point is occupied by two major oil refineries (Shell and Texaco). Padilla Bay, in general, is considered to be a significant natural resource by both the state and federal government. The east side of the bay has been designated a conservation area and nature preserve by the state of Washington.

Land Use Designations: March Point is zoned for industrial uses and the Skagit County Shoreline Master Plan has designated the area as "urban."

Public Facilities: March Point is served by public water of sufficient capacity to serve this use. There are no public sanitary waste facilities serving the point. The refineries presently utilize onsite disposal systems. Power is supplied by the Puget Power Company. The area is presently served by the Burlington Northern Railroad over existing lines. No preliminary planning or engineering feasibility work has been conducted to date.

### Constraints:

- o The project would require either the acquisition of a large number of individual properties and the dislocation of existing residents, or the filling of wetlands.
- o Train traffic will be routed through an existing congested urban area (Mt. Vernon).

Anacortes (continued)

Opportunities:

- o The site has access to deep water.
- o The area is zoned for heavy industry.
- o Most public services are presently available to the area.
- o The area is located in an air quality "attainment" area.

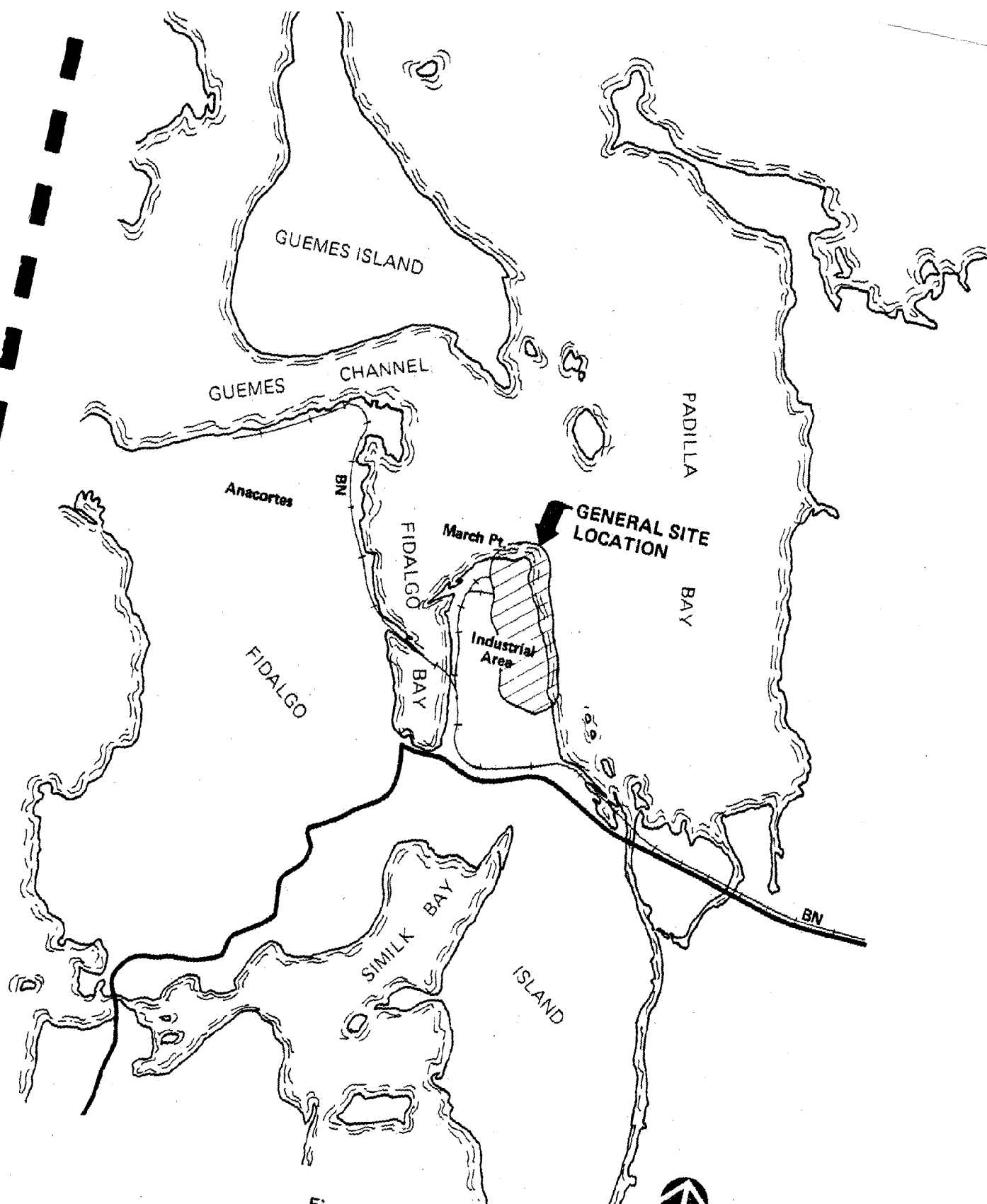


Figure 15  
ANACORTES TERMINAL SITE

Scale = 1:100,000

# ANACORTES

## EVALUATION OF IMPACT ISSUES

Impact Categories	Potential Impact Issues	Minor or Non-Issues
<b>Earth</b>		
Changes to local topography	●	
Surface compaction	●	
Alteration of longshore transport	●	
<b>Air</b>		
Elevated dust emissions	●	
Emissions from ships, trains and other vehicles	●	
<b>Water</b>		
Modification of hydrologic regimes	●	
Elevated levels of runoff	●	
Degradation of adjacent surface waters by windblown dust	●	
Increased turbidity due to dredging /disposal		●
<b>Flora and Fauna</b>		
Degradation of adjacent wetland habitat		●
Degradation of adjacent aquatic habitat	●	
Degradation of adjacent terrestrial habitat	●	
Disruption of corridors and fish migratory pathways	●	
Rare or endangered species impacts	●	
<b>Other</b>		
Noise pollution	●	
Light and glare generation	●	
Alteration of land use designations		●
Potential for onsite accidents	●	
Potential for ship accidents	●	
Traffic congestion at grade crossings	●	
Increased demand for public services	●	
Increased demand for utilities	●	
Aesthetic impact	●	
Disruption of recreational/commercial fishing	●	
Disruption of general recreational activities		●
Archaeological/historical resource impacts	●	
Competing uses <b>for land and shoreline</b>	●	

## Tulalip

Public Sponsor(s): Tulalip Tribes, Inc.  
Port of Everett (Tentative)  
Participants: Undisclosed  
Consultants: DRAWO, Inc., Bechtel, Inc.  
Principal  
Regulatory Agency: Bureau of Indian Affairs

Project Description: The proposed coal port facility would be divided into two major elements. Rail car unloading, weighing, sampling and storage would be located on an upland site with ship loading and berthing located in deep water. The two elements would be connected with either a conveyor system or a slurry pipeline. The conveyor system alternative would require approximately 8,000 feet of conveyor line and a "surge" storage area on the landside, immediately south of Tulalip Bay. The slurry pipeline alternative would have approximately five miles of buried line and a dewatering facility at the dock to recycle the transport water. At this time the slurry pipeline is preferred by the tribe over the conveyor system because it allows ship berthing to occur further away from areas of fish migration and has less visual impact on the Tulalip community. Neither alternative requires dredging.

The site will contain approximately 900 acres, although up to 1,500 acres is available if required.

Location: The site is located on the Tulalip Indian Reservation immediately to the west of Marysville, Washington. The upland portion of the facility would be located approximately 3-1/2 miles to the northeast of Tulalip Bay. The location of the waterside portion depends on whether the conveyor or the slurry pipeline system is utilized. If the conveyor system is used, the dock and ship loading facilities would be located approximately 800 feet to the south of Mission Beach. If a slurry pipeline is used, these facilities would be approximately 10,000 feet to the south of Mission Beach.

Capacity: Total potential upland capacity is 45 million short tons per year. At present, a 15-million-short-ton-per-year throughput capacity is planned.

Setting: The upland area is generally covered with second growth Douglas fir forest. No wetlands have been identified on the upland site which would be significantly altered. Also, no unique or endangered species habitats have been identified in the area.

Land Use Designations: The upland site is planned and zoned for industrial uses. Because the project is within tribal boundaries, state shoreline requirements and regulations would not apply to those portions of the project lying shoreward of extreme low water. Those portions of the project, including the dock and ship loading facilities beyond extreme low water would be subject to state regulation and this area is designated on the Snohomish County Shoreline Master Plan as "conservancy."

### Tulalip (continued)

Public Facilities: Most necessary public services would be provided by the Tulalip Tribe. The Snohomish County Public Utility District No. 1 would provide power. Water would be supplied by onsite wells and treatment for domestic waste would be provided by the existing treatment plant owned by the tribe. Road access would be from Interstate 5 to 116th Street NE. A new road would have to be constructed from 116th Street NE to the site.

Coal would be transported to the site by the Burlington Northern Railroad, and would require the addition of approximately three miles of new spur track.

### Constraints:

- o The location of the upland storage site requires either a conveyor or slurry pipeline system that is substantially longer than competitive systems.
- o Train traffic must pass through a congested urban area (Marysville).
- o Some major services, including water supply, are not currently available on the site.
- o Fish migration patterns could be impacted by the location of berthing and loading facilities near shore.
- o Development may interfere with commerce and navigation.

### Opportunities:

- o Extensive acreage is available for site development.
- o No filling or dredging of wetland will be required.
- o The site is located in an air quality "attainment" area.
- o The project is in conformance with the adopted Tribal Master Plan.
- o The site has access to deep water (60-plus feet).

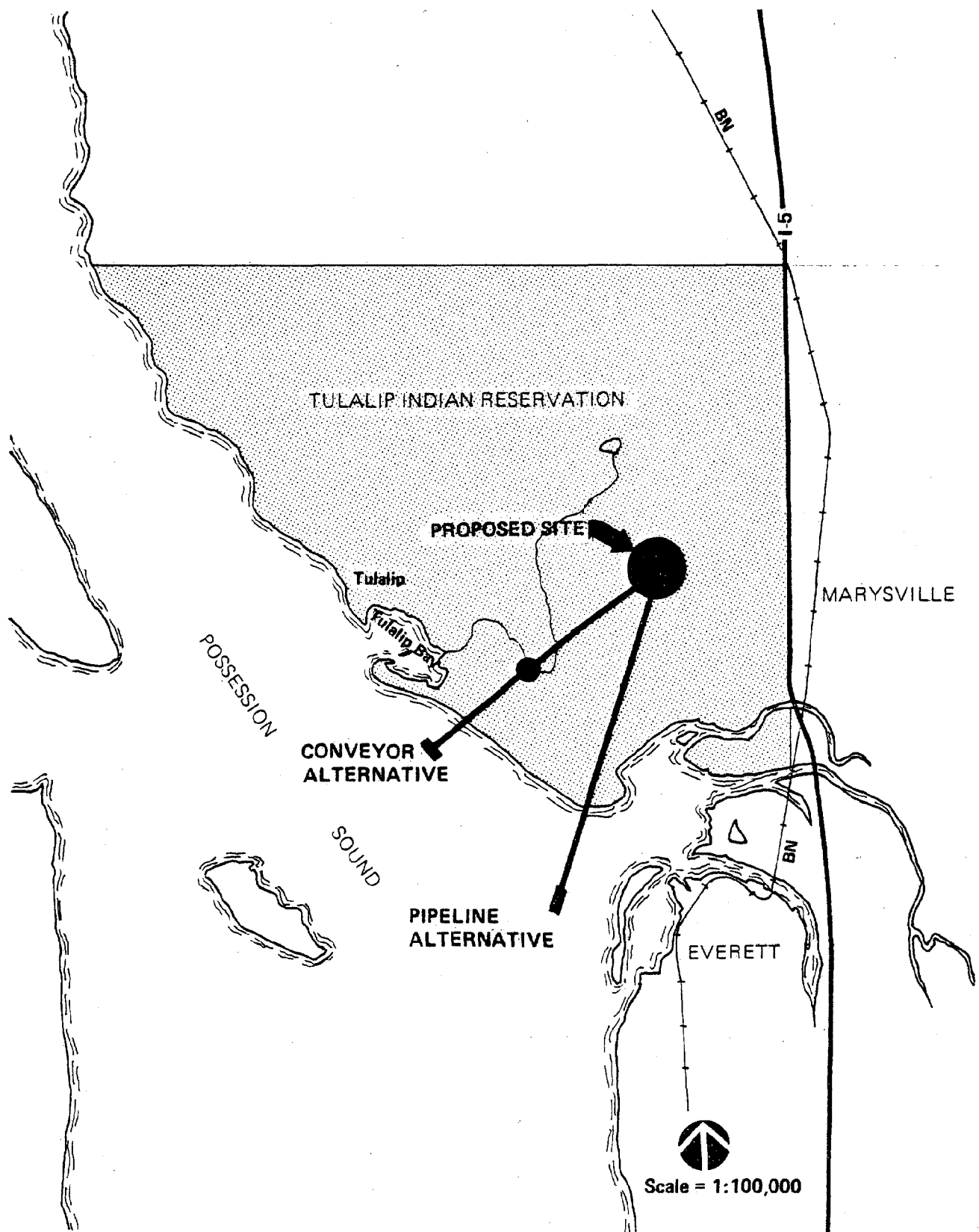


Figure 16  
TULALIP TERMINAL SITE

# TULALIP EVALUATION OF IMPACT ISSUES

Impact Categories	Potential Impact Issues	Minor or Non-Issues
<b>Earth</b>		
Changes to local topography	●	
Surface compaction	●	
Alteration of longshore transport	●	
<b>Air</b>		
Elevated dust emissions	●	
Emissions from ships, trains and other vehicles	●	
<b>Water</b>		
Modification of hydrologic regimes	●	
Elevated levels of runoff	●	
Degradation of adjacent surface waters by windblown dust	●	
Increased turbidity due to dredging /disposal		●
<b>Flora and Fauna</b>		
Degradation of adjacent wetland habitat		●
Degradation of adjacent aquatic habitat		●
Degradation of adjacent terrestrial habitat	●	
Disruption of corridors and fish migratory pathways	●	
Rare or endangered species impacts		●
<b>Other</b>		
Noise pollution		●
Light and glare generation	●	
Alteration of land use designations		●
Potential for onsite accidents	●	
Potential for ship accidents	●	
Traffic congestion at grade crossings	●	
Increased demand for public services		●
Increased demand for utilities	●	
Aesthetic impact	●	
Disruption of recreational/commercial fishing	●	
Disruption of general recreational activities		●
Archaeological/historical resource impacts	●	
Competing uses for land and shoreline		●

Steilacoom (Lone Star)

Public Sponsor(s): Unidentified  
Participants: Lone Star Industries, Inc.  
Consultants: Unidentified  
Principal  
Regulatory Agency: Pierce County

Project Description: The project involves 100-plus acres of a 400-plus acre sand and gravel mining operation. Navigable water depths of 100 feet occur within 400 feet of the site shoreline. No preliminary plans for the prospective coal operation are currently available.

Location: The site is at the location of the existing Lonestar sand and gravel operation near Steilacoom, west of Tacoma.

Capacity: The proposed facility would have a throughput capacity of up to 15 million tons per year.

Setting: The site itself is 100 to 200 feet in elevation below the surrounding countryside, due to past sand and gravel excavations. Residential development exists on adjacent properties to the north and east. Another gravel operation lies to the south of the site property.

Land Use Designations: The Pierce County Shorelines Master Plan designates the site shoreline as "conservancy," precluding development of a ship berth and coal loading operation. The site and surrounding areas are zoned for "general use." A special use permit was required for the existing sand and gravel operation.

Public Facilities: The project area is a developed industrialized site with water, sewer and electrical service in place. A double mainline track of the Burlington Northern and Union Pacific railroads service the site.

Constraints:

- o Current shorelines designation excludes development of a coal-loading terminal.
- o Some fairly dense residential areas exist nearby.
- o A grade crossing exists at a nearby ferry terminal.

Steilacoom (Lone Star) (continued)

Opportunities:

- o The site is already developed industrially.
- o The site is at a lower elevation than surroundings and has a tree buffer.
- o Deep drafts are available without dredging.

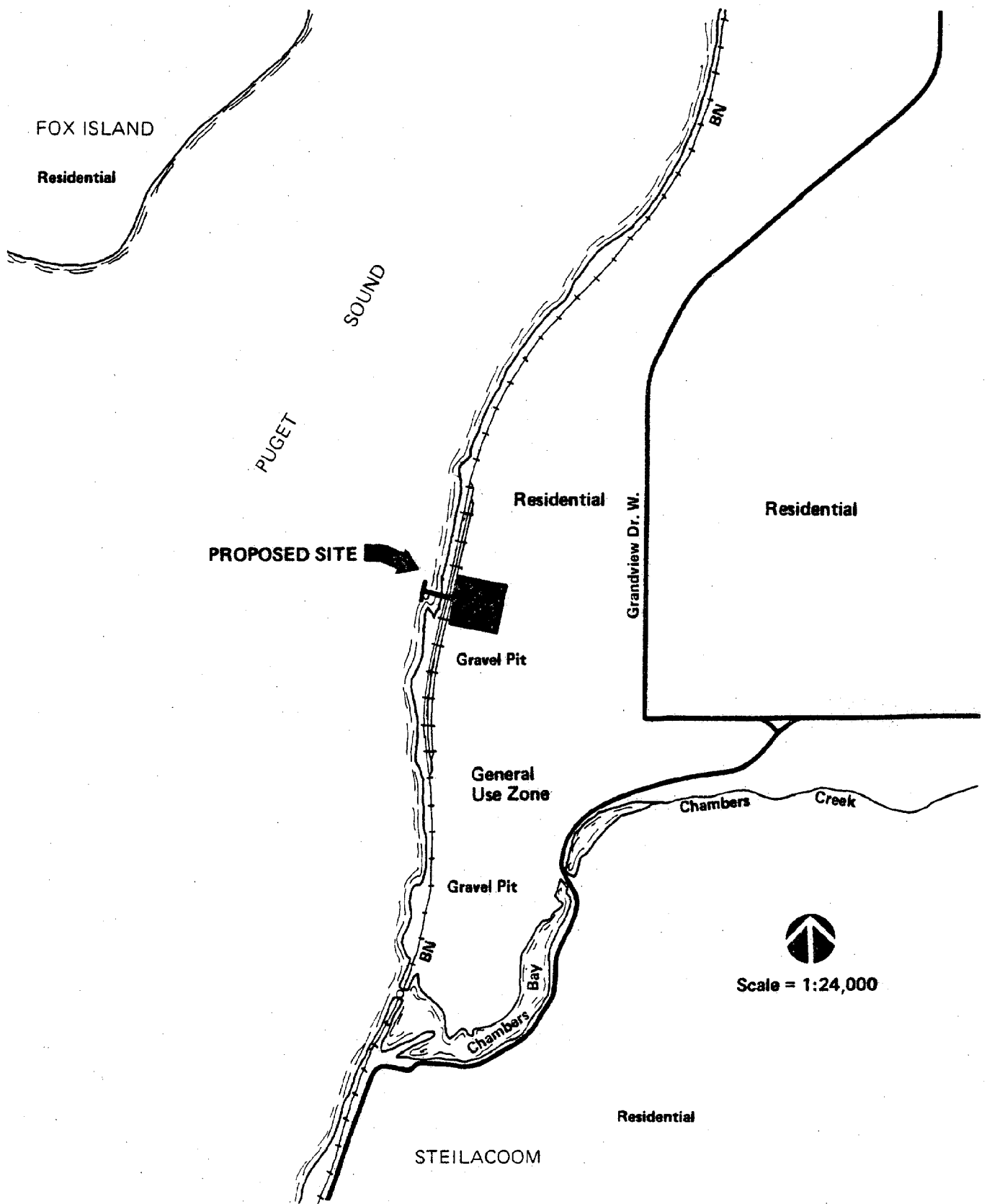


Figure 17  
STEILACOOM TERMINAL SITE

# **STEILACOOM (LONE STAR) EVALUATION OF IMPACT ISSUES**

Impact Categories	Potential Impact Issues	Minor or Non-Issues
<b>Earth</b>		
Changes to local topography		●
Surface compaction		●
Alteration of longshore transport	●	
<b>Air</b>		
Elevated dust emissions	●	
Emissions from ships, trains and other vehicles	●	
<b>Water</b>		
Modification of hydrologic regimes		●
Elevated levels of runoff	●	
Degradation of adjacent surface waters by windblown dust	●	
Increased turbidity due to dredging /disposal		●
<b>Flora and Fauna</b>		
Degradation of adjacent wetland habitat		●
Degradation of adjacent aquatic habitat	●	
Degradation of adjacent terrestrial habitat		●
Disruption of corridors and fish migratory pathways	●	
Rare or endangered species impacts		●
<b>Other</b>		
Noise pollution	●	
Light and glare generation		●
Alteration of land use designations	●	
Potential for onsite accidents	●	
Potential for ship accidents	●	
Traffic congestion at grade crossings	●	
Increased demand for public services		●
Increased demand for utilities		●
Aesthetic impact		●
Disruption of recreational/commercial fishing		●
Disruption of general recreational activities		●
Archaeological/historical resource impacts		●
Competing uses for land and shoreline		●

## Grays Harbor

Public Sponsor(s): Port of Grays Harbor  
Participants: Undisclosed  
Consultants: Orba Corp., ABAM Engineers, George Noble & Assoc., and  
GeoEngineers  
Principal  
Regulatory Agency: Grays Harbor County

Project Description: The proposed project involves a 176-acre site which has historically been used as a dredged material disposal site. The project is defined as a joint coal/grain export facility. The receiving track provides for two-unit coal trains and an inside loop is designed for grain trains. Reclaiming of coal will be accomplished at the bottom of the coal pile through a tunnel. The pier will be pile supported, approximately 64 feet wide and 1,000 feet long, and will be connected to the onshore facility by a long trestle supporting a coal conveyor belt. (The port has tentatively identified a second 72-acre site at Terminal 2 as an alternative location for spot shipments of coal. The following discussions deal only with the larger site.)

Location: The site is located on the south shore of Grays Harbor, and is situated between the Newkah River and Charlie Creek between State Highway 105 and the Burlington Northern rail line to Markham.

Capacity: The project is designed to handle up to 10 million tons annual throughput.

Setting: The site was used (from 1973 to 1981) as a disposal area for dredged material. The surrounding areas could be characterized as partially disturbed wood and meadow lands.

Land Use Designations: The Shoreline Management designation of the site and adjoining land areas is "Urban." However, the adjoining water areas are designated as "Conservancy" except the designation Navigation channel which is also "Urban." The proposed pier would be located in the conservancy environment. Docks, piers and other water-land connectors are a permitted use in the conservancy environment.

Public Facilities: The source of water supply for the site has not been determined. Electrical power will be provided by the Grays Harbor PUD No. 1. There are no public wastewater treatment facilities serving the site, and onsite treatment would probably be required. The Union Pacific mainline arriving from Chehalis/Centralia on the south shore would probably serve the site.

### Constraints:

- o Existing channel depths (-30 feet MLLW) are restrictive. Major dredging would be required.
- o A harbor line change is required.

Grays Harbor (continued)

Opportunities:

- o Grays Harbor has a self-maintaining bar and entrance channel. No maintenance dredging is projected for that area.
- o Grays Harbor is served by two mainline railroads.
- o All land use designations for the site and surrounding area indicate an industrial use.
- o The site is located in an air quality "attainment" area.

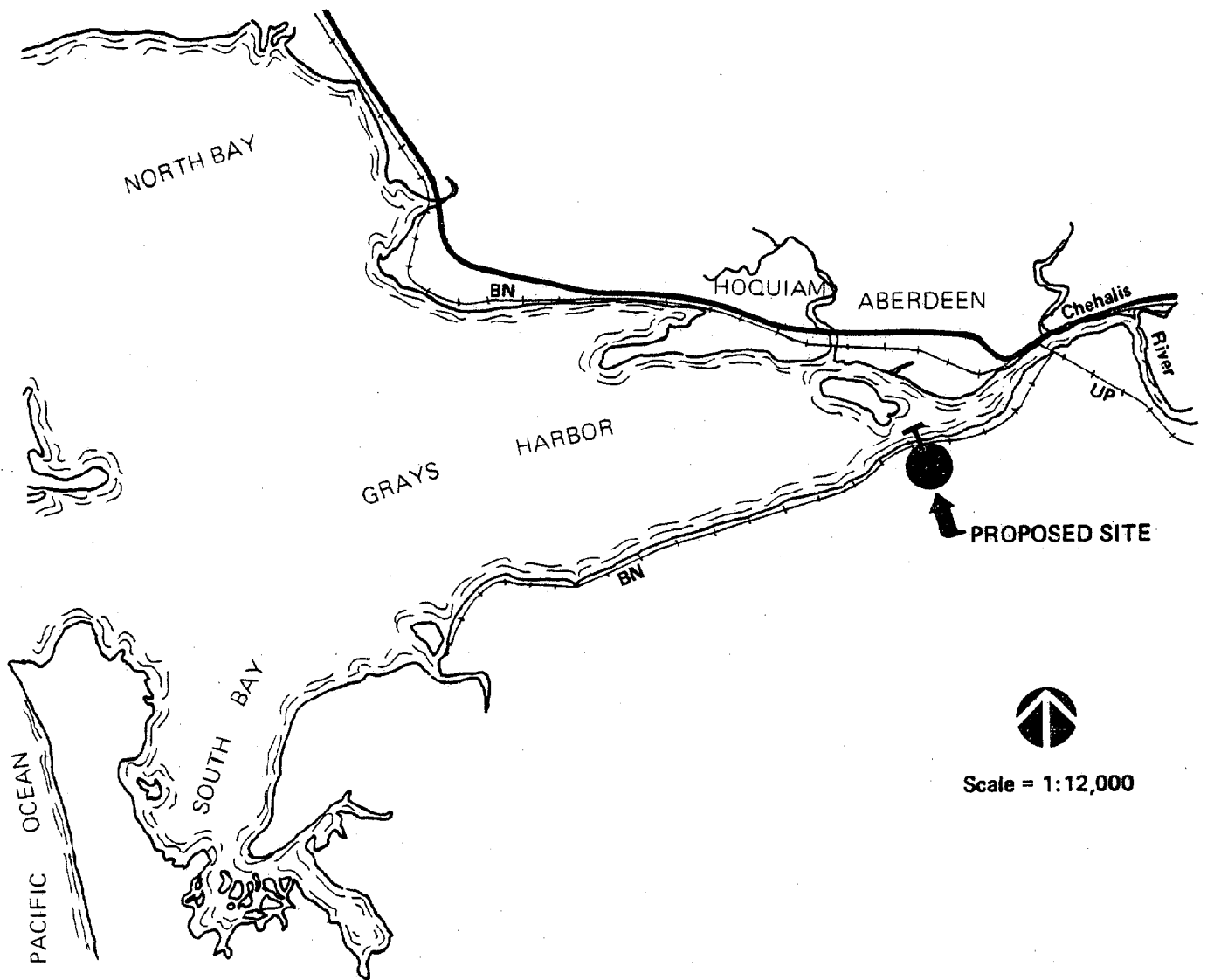


Figure 18  
GRAYS HARBOR TERMINAL SITE

# GRAYS HARBOR EVALUATION OF IMPACT ISSUES

Impact Categories	Potential Impact Issues	Minor or Non-Issues
<b>Earth</b>		
Changes to local topography	●	
Surface compaction	●	
Alteration of longshore transport	●	
<b>Air</b>		
Elevated dust emissions	●	
Emissions from ships, trains and other vehicles	●	
<b>Water</b>		
Modification of hydrologic regimes	●	
Elevated levels of runoff	●	
Degradation of adjacent surface waters by windblown dust	●	
Increased turbidity due to dredging /disposal	●	
<b>Flora and Fauna</b>		
Degradation of adjacent wetland habitat	●	
Degradation of adjacent aquatic habitat	●	
Degradation of adjacent terrestrial habitat	●	
Disruption of corridors and fish migratory pathways	●	
Rare or endangered species impacts		●
<b>Other</b>		
Noise pollution	●	
Light and glare generation	●	
Alteration of land use designations		●
Potential for onsite accidents	●	
Potential for ship accidents	●	
Traffic congestion at grade crossings	●	
Increased demand for public services		●
Increased demand for utilities	●	
Aesthetic impact	●	
Disruption of recreational/commercial fishing	●	
Disruption of general recreational activities		●
Archaeological/historical resource impacts		●
Competing uses for land and shoreline		●

## Kalama

Public Sponsor(s): Port of Kalama  
Participants: Pacific Resources, Inc.  
Consultants: Kramer, Chin & Mayo, Inc.; CH2M Hill, Inc.  
Principal  
Regulating Agency: Cowlitz County

Project Description: This facility will cover 175 acres, fronting on a 40-foot deep navigation channel, with sizeable throughput capacity. Current design plans include three berths, a 30-foot-high berm surrounding the facility, a loop spur rail line, six long coal pile storage areas, and a typical array of coal-handling and ancillary equipment. Berthing areas will be located near the edge of the main Columbia River navigation channel to minimize dredging requirements. An EIS has been completed for the site and all discretionary permits have been obtained. A preliminary engineering report has also been completed.

Location: The site is located north of the town of Kalama, near the north bank of the Kalama River, at the confluence of the Kalama and Columbia Rivers. Ship berths will extend several hundred feet into the Columbia River.

Capacity: Total planned potential capacity for this facility is 15 million tons per year of coal throughput.

Setting: The site is located in an area that has previously been used by the U.S. Army Corps of Engineers for dredged material disposal as part of the Mount St. Helens emergency dredging activities. About one-third of the site contains dredged material. The remainder of the site, which was cleared in anticipation of dredge disposal activities, has since grown back a mixture of wetland and lowland plant species. Surrounding areas include open and forested wetlands, the Burlington Northern right-of-way and I-5 corridor, and some recreational residential areas.

Land Use Designations: Cowlitz County has not zoned this area. However, the County's Comprehensive Land Use Plan designates the site area as "Industrial." Adjoining land north of the site is designated "Forestry/Open Space" and the shoreline of the Kalama River south of the site is designated "Conservancy" in the shoreline element of the Comprehensive Plan.

The County Shorelines Management Master Program is part of the Comprehensive Plan and designates the project site as "Urban," which allows industrial development. The area north of the site is designated "Conservancy."

Public Facilities: There are no existing water lines to the site. Potable water will be provided by either a connecting line to a nearby main or by development of a well onsite. The facility is designed to have its own sewage treatment plant. Electrical power to the site will be provided through the local Cowlitz County PUD. The Burlington Northern Railroad will serve the site over existing main line tracks.

Kalama (continued)

Constraints:

- o The site is located in an area of wetlands and other high quality fish and wildlife habitat.

Opportunities:

- o The site is located in an area designated for industrial development.
- o The NEPA/SEPA process has been completed for the project and all necessary permits have been procured to allow development to begin.
- o The adjacent rail route passes through relatively few highly populated areas.

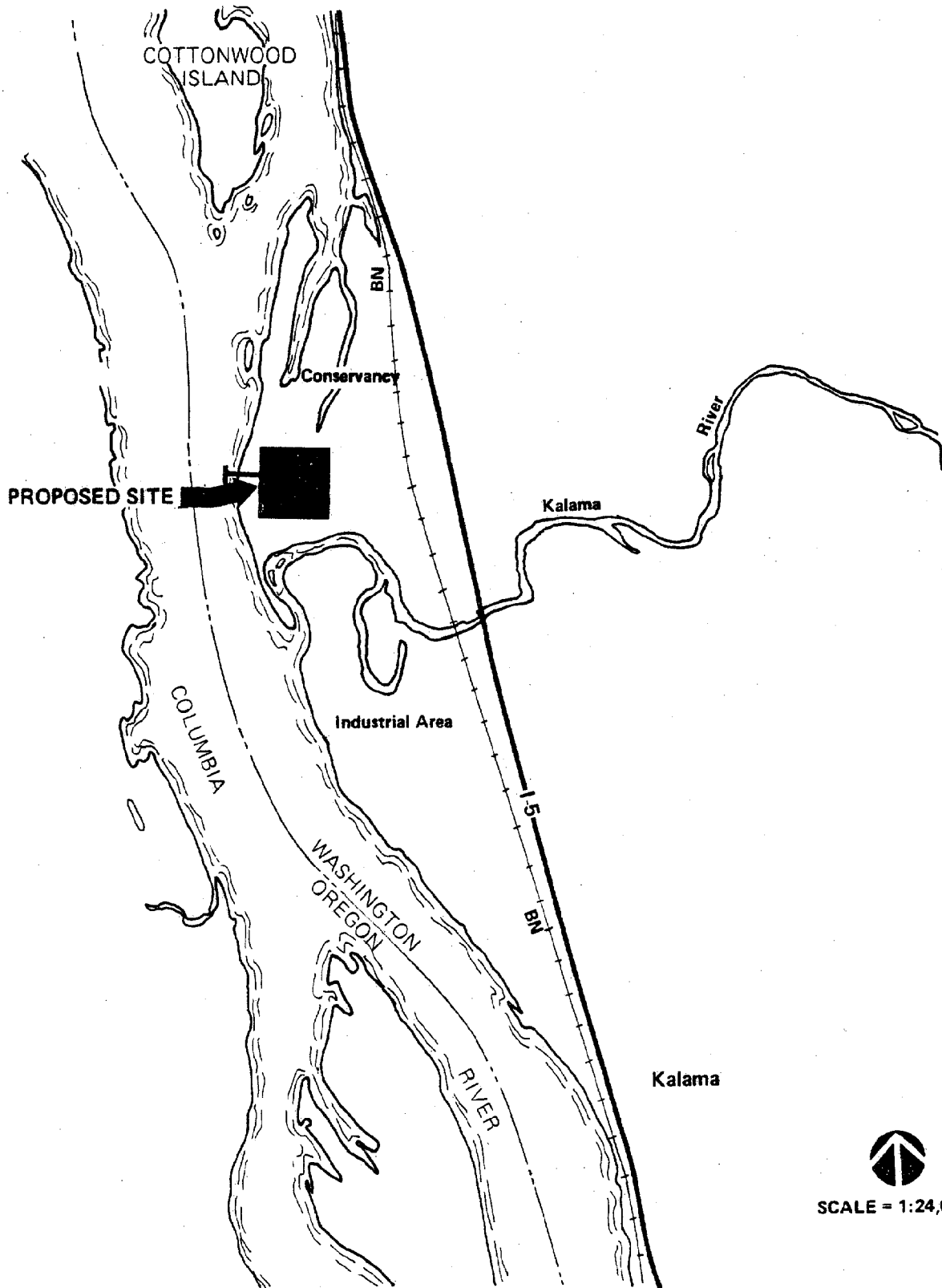


Figure 19  
KALAMA TERMINAL SITE

# KALAMA EVALUATION OF IMPACT ISSUES

Impact Categories	Potential Impact Issues	Minor or Non-Issues
<b>Earth</b>		
Changes to local topography	●	
Surface compaction	●	
Alteration of longshore transport	●	
<b>Air</b>		
Elevated dust emissions	●	
Emissions from ships, trains and other vehicles	●	
<b>Water</b>		
Modification of hydrologic regimes	●	
Elevated levels of runoff	●	
Degradation of adjacent surface waters by windblown dust	●	
Increased turbidity due to dredging /disposal	●	
<b>Flora and Fauna</b>		
Degradation of adjacent wetland habitat	●	
Degradation of adjacent aquatic habitat	●	
Degradation of adjacent terrestrial habitat	●	
Disruption of corridors and fish migratory pathways	●	
Rare or endangered species impacts		●
<b>Other</b>		
Noise pollution	●	
Light and glare generation	●	
Alteration of land use designations		●
Potential for onsite accidents	●	
Potential for ship accidents	●	
Traffic congestion at grade crossings	●	
Increased demand for public services		●
Increased demand for utilities	●	
Aesthetic impact		●
Disruption of recreational/commercial fishing		●
Disruption of general recreational activities		●
Archaeological/historical resource impacts	●	
Competing uses for land and shoreline	●	

## Vancouver

Public Sponsor(s): Port of Vancouver  
Participants: Westmoreland Resources, Inc.  
Consultants: Morrison-Knudsen Co., Inc.  
Principal  
Regulatory Agency: Clark County

Project Description: The proposed facility is a 42-acre site in an area which has predominantly been used for disposal of dredged material. Landside facilities will include a rail loop to accommodate unit trains, an underground coal car dump, pads for coal stockpiles, and conveying systems. The facility will be served by a 1,000-foot wharf extension to the port's existing Berth No. 8. The depth at berth is 40 feet.

Location: The project site is located near the city of Vancouver at river mile 104 of the Columbia River.

Capacity: The designed capacity of this site is 6 million tons per year.

Setting: Two-thirds of the site area is covered with dredged material. The remaining one-third consists of cropland, grasslands and woodlands. A 4-acre portion of the grasslands area has been identified as wetlands. The project site is bounded on the west by vacant land adjoining the ALCOA aluminum plant; on the east by a 600-foot-wide transmission line right-of-way, used for open storage of cargo by the Port of Vancouver; on the north by the Burlington Northern Railroad lead to the ALCOA plant, with vacant land north of that; and on the south by the Columbia River. About 25 acres of the site are covered with dredged material. The remainder of the property includes about 6 acres of cropland, 3 acres of black cottonwood trees, 1 acre of brush, and 7 acres of grassland.

Land Use Designation: The entire project site is designated by the Corps of Engineers, 1978 Columbia River Maintenance Disposal Plan as an active disposal site for dredged material (U.S. Army Corps of Engineers, 1976). The City and County Shorelines Master Program designates the area and the site as an "Urban Environment." The general policies of the program for this designation state, "Priority should be given to water-dependent uses." Ports and water-related industrial development are preferred uses here, though they require a Substantial Development Permit.

The Clark County Comprehensive Plan designates the project site as "Urban Area - Heavy Manufacturing." Current zoning, both city and county, on the property's surrounding areas is "Heavy Industrial."

Public Facilities: The site would be served by either a hookup to the existing public water supply or by an onsite well. Electrical power will be supplied by the Bonneville Power Administration via the Clark County PUD. The site can be serviced by either Union Pacific or Burlington Northern railroads over existing lines.

Vancouver (continued)

Constraints:

- o The site is located approximately one kilometer west of an area designated by EPA as nonattainment for total suspended particulates.
- o Vehicular access improvements may be required.
- o Cumulative rail traffic impacts are anticipated from expansion of other industries in the area.

Opportunities:

- o The site is located in an area planned for industrial activities.
- o There are existing industrial uses in the immediate area.
- o The site has been used as an area for dredged material disposal.

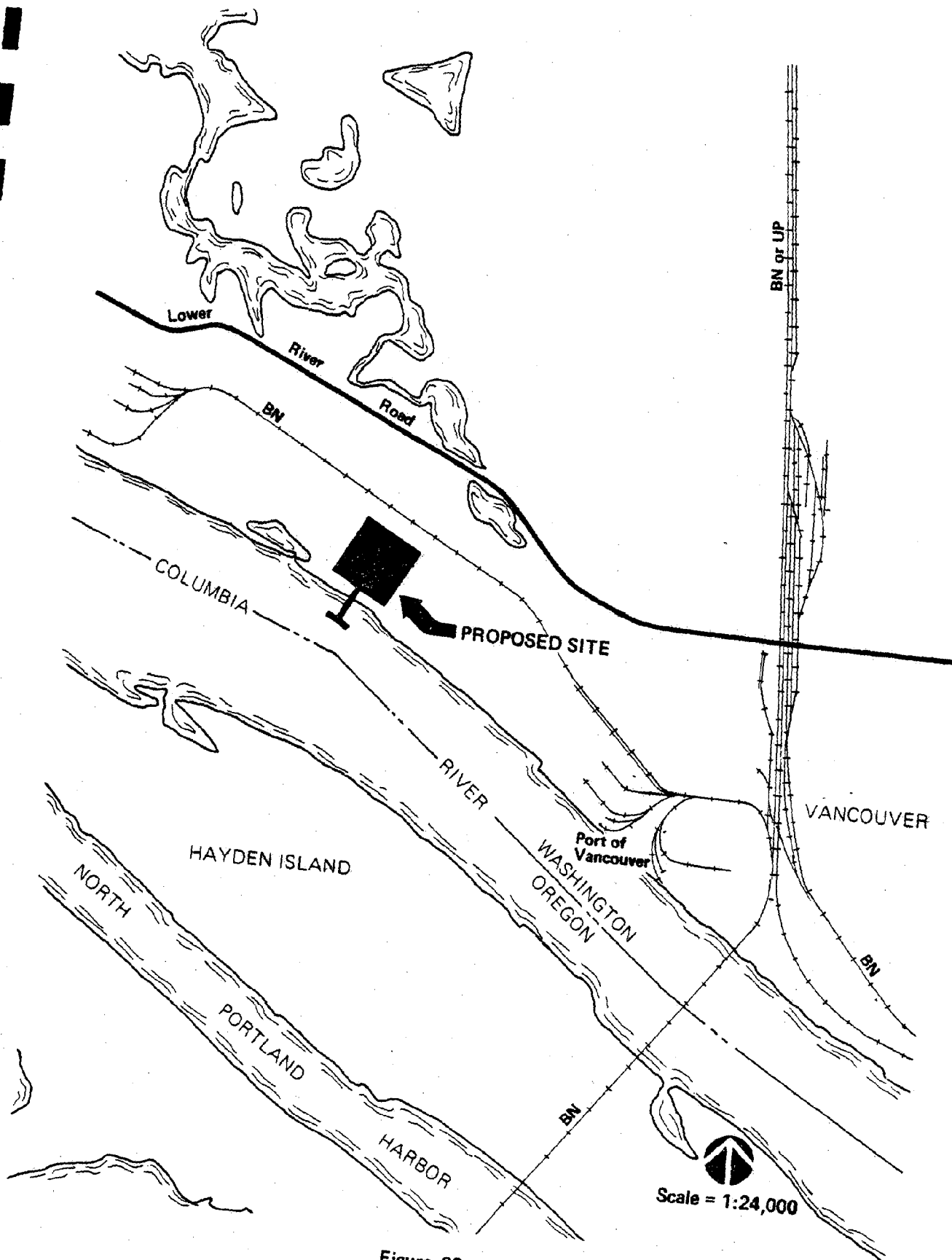


Figure 20  
VANCOUVER TERMINAL SITE

# VANCOUVER EVALUATION OF IMPACT ISSUES

Impact Categories	Potential Impact Issues	Minor or Non-Issues
<b>Earth</b>		
Changes to local topography		●
Surface compaction	●	
Alteration of longshore transport	●	
<b>Air</b>		
Elevated dust emissions	●	
Emissions from ships, trains and other vehicles	●	
<b>Water</b>		
Modification of hydrologic regimes	●	
Elevated levels of runoff	●	
Degradation of adjacent surface waters by windblown dust	●	
Increased turbidity due to dredging /disposal	●	
<b>Flora and Fauna</b>		
Degradation of adjacent wetland habitat	●	
Degradation of adjacent aquatic habitat	●	
Degradation of adjacent terrestrial habitat		●
Disruption of corridors and fish migratory pathways	●	
Rare or endangered species impacts		●
<b>Other</b>		
Noise pollution	●	
Light and glare generation	●	
Alteration of land use designations		●
Potential for onsite accidents	●	
Potential for ship accidents	●	
Traffic congestion at grade crossings	●	
Increased demand for public services		●
Increased demand for utilities	●	
Aesthetic impact		●
Disruption of recreational/commercial fishing		●
Disruption of general recreational activities		●
Archaeological/historical resource impacts	●	
Competing uses for land and shoreline		●

## VIII. IMPACT AVOIDANCE MEASURES

### Introduction

Impact avoidance includes all activities and measures, which can be incorporated into project design and concept, intended to eliminate, reduce or provide compensation for potential environmental impacts. Impact avoidance measures can be subdivided into three basic areas of consideration:

- o Siting measures
- o Design and operation measures
- o Mitigation measures

These impact avoidance measures are summarized in Table 18. How they apply to specific potential impacts is illustrated in the matrix shown in Figure 21. This matrix provides a guide to those impact avoidance measures potentially applicable to the impacts identified for each port area profiled in the previous chapter. A discussion of these measures follows.

An economic analysis of impact avoidance measures is summarized in this chapter to better define how the "cost of mitigation" can affect the construction and operation of a coal port facility. (A detailed cost analysis is presented in Appendix A.) Alternatives to expensive or non-cost-effective impact avoidance techniques are identified, where they exist.

### Siting Measures

Properly siting a coal transshipment facility can alleviate many environmental and regulatory concerns which can negate or stall a project.

One of the more frequent problems is siting on or near wetlands. There has been much concern, both governmental and private, over the past 10 years about the rate at which wetlands are disappearing within the continental U.S.

The importance of wetlands to the ecology of a region is well-documented. Wetlands provide buffers from storms and flooding by absorbing excess water into the organic matrix which serves as substrate. Wetlands serve as hydrological reserves where they slowly release stored water to ground and surface water reservoirs, which is important during times of drought. Wetlands can also filter out pollutants, such as suspended solid material, as water flows through the vegetation and organic matrix. Wetlands supply nutrients to marine and other aquatic habitats, enhancing productivity and serving as habitat, nursery grounds, and food sources for a large variety of plants and animals.

The Corps of Engineers have been given the mandate to protect wetlands and regulate certain construction activities within wetlands by virtue of Section 404 of the Clean Water Act. This agency may require an analysis of alternative sites before permitting work in a wetland.

Table 18

IMPACT AVOIDANCE MEASURES

Siting Measures

- o Site in industrialized area
- o Avoid areas which would impact wetlands or other critical habitats
- o Restrict shoreline siting to water-dependent facility components
- o Site in areas previously disturbed or with low habitat quality
- o Avoid noise-sensitive populations
- o Avoid floodways

Design and Operation Measures

- o Pier on piling design
- o Cover coal piles
- o Dust suppression sprays
- o Containment of coal-handling components
- o Pave roads and vegetate open areas
- o Appropriately sized retention basins
- o Avoid extensive dredging
- o Minimize component placement along shorelines and in shallow water
- o Configuration avoidance of important habitat areas
- o Perimeter berm/vegetative buffers
- o Daytime scheduling of noisy operations
- o Directed lighting to minimize glare
- o Use of glass refractorless luminaires
- o Allowance of public access to site property shoreline
- o Onsite safety measures
- o Installation of aids to navigation
- o Schedule trains for off-peak traffic hours
- o Construct overpasses
- o Break up unit trains to minimize crossing delays in congested areas
- o Road or track rerouting
- o Onsite firefighting equipment
- o Onsite potable water supply
- o Onsite sewage treatment
- o Allow fishing near piers where possible
- o Allow recreational rights-of-way where possible
- o Site survey by state-approved professional archaeologist/historian

Mitigation Measures

- o Onsite habitat enhancement
- o Offsite land purchase (habitat, recreation, etc.)
- o Funding of wildlife management

Environmental damage can be greatly minimized by locating coal storage facilities in areas previously disturbed and of low habitat quality such as in areas that are already industrialized.

Figure 21

# POTENTIAL IMPACT ISSUES/IMPACT AVOIDANCE MEASURES MATRIX

## POTENTIAL IMPACT ISSUES

### EARTH

CHANGES TO LOCAL TOPOGRAPHY  
SURFACE COMPACTION  
ALTERATION OF LONGSHORE TRANSPORT

### AIR

ELEVATED DUST EMISSIONS  
EMISSIONS FROM SHIPS, TRAINS AND  
OTHER VEHICLES

### WATER

MODIFICATION OF HYDROLOGIC REGIMES  
ELEVATED LEVELS OF RUNOFF  
DEGRADATION OF ADJACENT SURFACE  
WATERS BY WINDBLOWN DUST  
INCREASED TURBIDITY DUE TO DREDGING /DISPOSAL

### FLORA AND FAUNA

DEGRADATION OF ADJACENT WETLAND HABITAT  
DEGRADATION OF ADJACENT AQUATIC HABITAT  
DEGRADATION OF ADJACENT TERRESTRIAL HABITAT  
DISRUPTION OF CORRIDORS AND FISH MIGRATORY  
PATHWAYS  
RARE OR ENDANGERED SPECIES IMPACTS

### OTHER

NOISE POLLUTION  
LIGHT AND GLARE GENERATION  
ALTERATION OF LAND USE DESIGNATIONS  
POTENTIAL FOR ONSITE ACCIDENTS  
POTENTIAL FOR SHIP ACCIDENTS  
TRAFFIC CONGESTION AT GRADE CROSSINGS  
INCREASED DEMAND FOR PUBLIC SERVICES  
INCREASED DEMAND FOR UTILITIES  
AESTHETIC IMPACT  
DISRUPTION OF RECREATIONAL/COMMERCIAL FISHING  
DISRUPTION OF GENERAL RECREATIONAL ACTIVITIES  
ARCHAEOLOGICAL/HISTORICAL RESOURCE IMPACTS  
COMPETING USES FOR LAND AND SHORELINE

## IMPACT AVOIDANCE MEASURES

### BITING MEASURES

SITE IN INDUSTRIALIZED AREA  
AVOID AREAS WHICH WOULD IMPACT WETLANDS OR OTHER  
CRITICAL HABITATS  
RESTRICT SUBSIDENCE SITUING TO WATER DEPENDENT FACILITY  
COMPONENTS  
SITE IN AREAS PREVIOUSLY DISTURBED OR WITH LOW HABITAT  
QUALITY  
AVOID NOISE SENSITIVE POPULATIONS  
AVOID FLOODWAYS

### DESIGN AND OPERATION MEASURES

PIER ON PILING DESIGN  
COVER COAL PILES  
DUST SUPPRESSION SPRAYS  
CONTAINMENT OF COAL HANDLING COMPONENTS  
PAVE ROADS AND VEGETATE OPEN AREAS  
APPROPRIATELY SIZED RETENTION BASINS  
AVOID EXTENSIVE DREDGING  
MINIMIZE COMPONENT PLACEMENT ALONG SHORELINES AND  
IN SHALLOW WATER  
CONFIGURATION AVOIDANCE OF IMPORTANT HABITAT AREAS  
PERIMETER BERM/VEGETATIVE BUFFERS  
DAYTIME SCHEDULING OF NOISY OPERATIONS  
DIRECTED LIGHTING TO MINIMIZE GLARE  
USE OF GLASS REFLECTORLESS LUMINAIRES  
ALLOWANCE OF PUBLIC ACCESS TO SITE PROPERTY SHORELINE

ONSITE SAFETY MEASURES  
INSTALLATION OF AIDS TO NAVIGATION  
SCHEDULE TRAINS FOR OFF PEAK TRAFFIC HOURS  
CONSTRUCT OVERPASSES  
BRK UP UNIT TRAINS TO MINIMIZE CROSSING DELAYS IN  
CONGESTED AREAS  
ROAD REROUTING  
ONSITE FIRE FIGHTING EQUIPMENT  
ONSITE POTABLE WATER SUPPLY  
ONSITE SEWAGE TREATMENT  
ALLOW FISHING NEAR PIERS WHERE POSSIBLE  
ALLOW RECREATIONAL RIGHTS OF WAY WHERE POSSIBLE  
SITE SURVEY BY STATE APPROVED PROFESSIONAL  
ARCHAEOLOGIST/HISTORIAN  
MITIGATION MEASURES  
ONSITE HABITAT ENHANCEMENT  
OFF SITE LAND PURCHASE (HABITAT, RECREATION, ETC.)  
FUNDING OF WILDLIFE MANAGEMENT

The nature of the coal port operations dictates siting along rivers and coastlines. Rivers and coastlines are in great demand not only for industrial sites but also as residential, recreational and commercial locations. In addition, siting in a floodplain area involves the additional concern of raising flood waters above predevelopment levels. Placing only water-dependent components of a facility on a shoreline and locating other components landward of the shoreline preferably on upland locations would be preferable to siting an entire installation linearly along a coastline or floodplain.

Although the technology for noise and dust suppression is relatively advanced, operational noise and fugitive dust are critical impacts over which there is still much public concern. As much as possible, populated areas (other than already industrialized locations) should be avoided in choosing a facility site.

#### Design and Operation Measures

Although many impacts can be avoided by proper siting, there are a variety of design and operational measures which can reduce the extent of environmental disturbance. Control technology has quickly evolved in the last decade in response to a proliferation of environmental regulations.

Coal handling and storage activities have a number of impact considerations which must be accounted for when designing and operating a facility. Because of the friability of coal, particles disassociate as coal dust, which are easily transported by wind and water.

Dust prevention, dust control and runoff control and treatment are prime considerations in the design and operation of a coal handling facility. Windbreaks, water spray and, for long-term containment, coagulating chemicals can suppress dust. A variety of enclosures and hoods situated along conveyor belts and at dumping and loading sites can contain dust for proper disposal. Efficient drainage design, proper treatment of coal pile runoff both from rainfall and from dust suppression and washdowns, and sufficiently sized retention basins can do much to reduce the environmental disruption of air-borne and water-borne coal particles. Table 19 provides a listing of appropriate runoff treatment elements.

TABLE 19  
COAL PORT RUNOFF TREATMENT ELEMENTS

	Minimum Treatment	Full Treatment
Collection	X	X
Settling	X	X
Coagulation		X
Precipitation		X
Final Settling		X
pH Adjustment	X	X
Filtration		X
Sterilization		Special
Ion Exchange		Special
Reuse	X	X
Discharge	X	X

Dredging can alter the extent and continuity of shallow water necessary for outmigration and feeding of young salmonids. Depending on the dredging site, toxic chemicals can be resuspended in the water column. Dredging also can remove eelgrass beds and other types of prime aquatic and marine habitat. General shoreline construction and solid piers and jetties can interfere with longshore sediment transport causing sediment to accrete upcurrent and to erode downcurrent of the structure. Designing coal storage facilities where extensive dredging, shoreline construction, and solid piers and jetties are not required reduces the chances of disrupting natural shoreline processes and fish and wildlife habitat.

Coal facility operations can generate significant amounts of noise. Buffer zones containing dense vegetation around a facility, equipment designed to operate quietly, and the scheduling of the more noisy operations during daylight hours can significantly reduce the effects of noise on surrounding communities.

Other design and operation impact avoidance measures are listed in Table 18 to mitigate the following identified impacts:

- o Light and glare generation
- o Alteration of land use designations
- o Potential for onsite accidents
- o Potential for ship accidents
- o Traffic congestion at grade crossings
- o Increased demand for public services
- o Increased demand for utilities
- o Aesthetic impact
- o Disruption of recreational/commercial fishing
- o Disruption of general recreational activities
- o Archaeological/historical resource impacts
- o Competing uses for land and shoreline

The relationship between these impacts and specific avoidance measures is illustrated in the matrix presented in Figure 20.

#### Mitigation Measures

Mitigation is a principle for reducing or compensating for the unavoidable disruption to wildlife habitat. It is the result of a process of negotiation between federal, state and local government entities and the developer. It can take a variety of forms, but generally includes one or more of the following aspects:

- o On-site habitat enhancement such as revegetation, restoration of filled and diked areas, and wetland formation. Another effective measure is redeposition of suitable sediments on riprap to allow rapid recolonization of food organisms utilized by juvenile salmonids.
- o Off-site land purchase and dedication as wildlife habitat for a certain period of time or in perpetuity.
- o Recreational land purchases.
- o Establishing a fund for wildlife habitat management either in combination with off-site land purchase or on lands already utilized for wildlife habitat. This frequently takes the form of raising game birds, stocking fish, revegetating and restoring an area, or constructing fences.

#### Economic Evaluation Summary of Impact Avoidance

An economic evaluation of impact avoidance measures is summarized in this section. A detailed analysis is found in Appendix A. Since many impact avoidance measures are already incorporated in a standard coal facility, the economic evaluation focuses on those impact avoidance measures that can add significantly to the delivered cost of coal to the Pacific rim. This analysis identifies impact avoidance measures which can severely affect the cost effectiveness, and ultimately the feasibility of a coal port facility. Costs for a "typical" coal operation are estimated first, and all significant impact avoidance measures are evaluated in relation to this "typical" operation. Also, alternative impact avoidance measures are suggested, when available, which can mitigate the same impacts at a lower cost.

#### Summary

The total cost per ton of coal delivered to an Asian port through a typical 10-million-ton-per-year facility is estimated for this analysis to be \$49.58 per ton. Figure 22 illustrates the breakdown in costs per ton of coal. As shown, transportation costs (rail and shipping) make up almost 75 percent of the total cost of coal. In contrast, actual facility costs are a very small portion of the total cost, at 6 percent. This suggests that impact avoidance measures affecting transportation will likely have more impact on the total cost of coal than those affecting the actual facility.

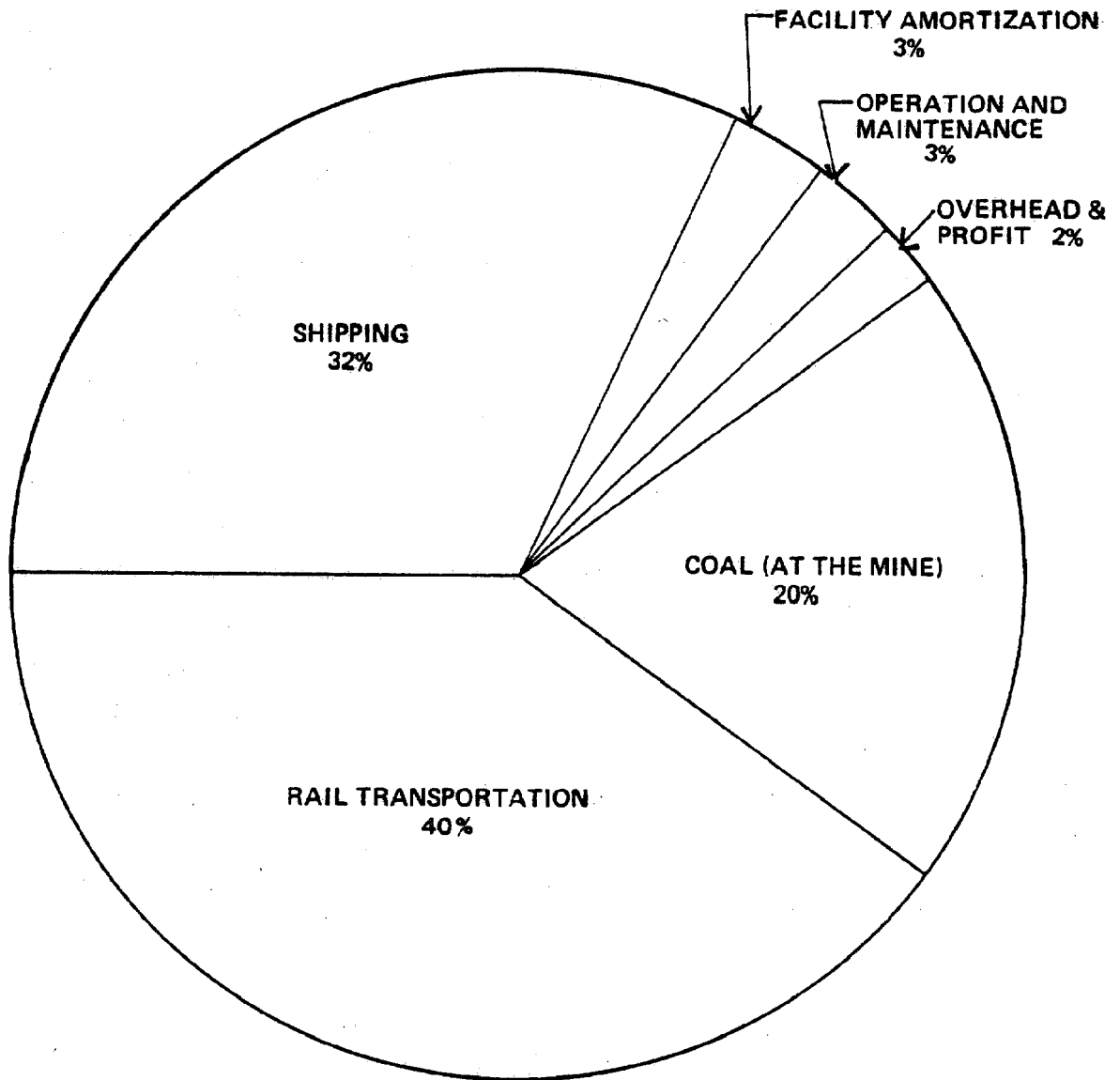
Table 20 summarizes impact avoidance costs, including standard environmental protection devices already included in the capital costs of the facility.

Table 20 summarizes impact avoidance costs, including standard environmental protection devices already included in the capital costs of the facility. As shown, most impact avoidance measures have a very small effect on the total cost of coal. However, restriction of facility operations and enclosure of coal piles could affect the ultimate financial feasibility of one site over another.

The costs of impact avoidance measures can be minimized in almost all cases by appropriate site location and use of state-of-the-art environmental protection devices. However, the developer will likely have to fund source mitigation measures at a relatively small cost. Suggested financing approaches include direct financing of impact mitigation measures and/or the use of a surcharge on each ton of coal.

Figure 22

Total Cost of Coal



Total Cost Per Ton \$49.58

TABLE 20  
SUMMARY OF IMPACT AVOIDANCE COSTS  
(1982 dollars)

<u>Description</u>	<u>Annual Cost</u>	<u>Cost per Ton of Coal*</u>	<u>% of Total Cost of Coal**</u>	<u>Alternative Measures</u>
(Costs of less than \$4.5 million are indicated as 1%)				
Standard Environmental Protection Devices	\$ 1,000,000	\$.10	1%	None
Habitat Management	340,000	.03	1%	Site location
Enclosure of Coal Piles	9,000,000	.90	2%	Site location State-of-the-art environmental protection devices
Restriction of Operating Hours	15,550,000	1.56	3%	Site location Noise mitigation
Replacement of Recreational Areas	40,000	.01	1%	Site location
Commercial Fishing Management	250,000	.03	1%	Site location
Railroad Grade Separation	800,000	.08	1%	Site location Alternative routing Signalization
Signalization	200,000	.02	1%	Site location

\* Assumed terminal capacity is 10 million tons per year.

\*\* Total cost of coal is \$49.58 per ton.

Source: WK&A

## REFERENCES

Alaska Dept. of Transportation and Public Facilities. Modular Port Facility Requirements Forecasts. 1982.

Anonymous. United States - Confronting Constraints to Steam Coal Exports, In Bulk Systems. May, 1980.

Bogden, Roger. Washington Dept. of Game Personal Communication. 1982.

Central Puget Sound Economic Development District. Puget Sound Coal Export Opportunities and Issues. 1982.

Cross, F.L. "Coal Pile Environmental Impact Problems," Pollution Engineering 13:35-37. 1981.

Davis, E. "Coal Pile Leachate Quality," Journal of Environmental Engineering Division ASCE, Vol. EE2, pp.399-417. 1981.

Davis, E. "A Review of Water Quality Issues Associated with Coal Storage," Journal of Environmental Quality 10:127-133. 1981.

Fenton, Gary. Washington Dept. of Game Personal Communication. 1982.

George, Leo. Burlington Northern Personal Communication. 1982.

Gerhart, E.H. et al "Histological Effects and Bioaccumulation Potential of Coal Particulate-Bound Phenanthrene in the Fathead Minnow Pimephales promelas," Environmental Pollution Series A, 25:165-180. 1981.

Green, P. "Laying Fugitive Dust to Rest." Coal Age, August: 72-78. 1982.

Howerton, Jack. Washington Dept. of Game Personal Communication. 1982.

Karagianes, M.T. et al. "Effects of Inhaled Diesel Emissions and Coal Dust in Rats." American Industrial Hygiene Association Journal, 42:382-391. 1981.

Meade, George. Pacific Resources Personal Communication. 1982.

Michigan. Coastal Energy Impact Program. Coastal Effects of Coal Transshipment in Michigan: An Evaluation Strategy. 1980.

Michigan Coastal Energy Impact Program. Michigan Coastal Coal Storage. n.d.

Miller, Steve. Burlington Northern Personal Communication. 1982

MIT. Coal-Bridge to the Future. 1980.

Morrison-Knudsen Company, Inc. Port of Vancouver Noise Technical Support Document. 1982.

Morrison-Knudsen Company, Inc. Vancouver Coal Terminal, Air Quality Technical Support Document, Draft Environmental Impact Statement. 1982.

Odell, Glen. Seton, Johnson & Odell Personal Communication. 1982.

Odum, W.E. "Sorption of Pollutants by Plant Detritus." Environmental Health Perspectives, 27:133-137. 1978.

Oregon Department of Energy. Feasibility Study and Executive Summary for Coal Export Study at Tongue Point. 1981.

Pelham, L. The Environmental Impact of Coal Transfer and Terminal Operations, EPA 600/7-80-169. 1980.

Port of Grays Harbor. Coal/Grain: A Technical Feasibility Study for an Export Terminal at the Port of Grays Harbor, Aberdeen, Washington. 1981.

Port of Kalama. Final Environmental Impact Statement, Port of Kalama Marina Industrial Park and Bulk-Handling Facility. 1982.

Port of Vancouver. Final EIS, Vancouver Coal Terminal. 1982.

Portland Marine Task Group. WESTPO, Report 5. 1982.

Scullion, J. "The Effect of Pollutants from the Coal Industry on the Fish Fauna of a Small River in the South Wales Coalfield." Environmental Pollution Series A. 21:141-153. 1980.

Soros, P. "An Environmentally Acceptable Coal Port," In Ports 80. 11-30. 1981.

Tripp, B.W. et al. "Unburned Coal as a Source of Hydrocarbons in Surface Sediments," Marine Pollution Bulletin. 12:122-126. 1981.

U.S. Army Corps of Engineers. Final Environmental Statement - Rail-to-Barge Coal Transfer Facility, St. Louis, Missouri. 1976.

U.S. Congress, Office of Technology Assessment (OTA). The Direct Use of Coal. Washington, D.C.: Government Printing Office, 1979.

U.S. Department of Commerce Maritime Administration. Port Handbook for Estimating Marine Terminal Cargo Handling Capabilities. 1979.

United States Dept. of Energy. Interagency Coal Export Task Force Interim Report. 1981.

United States Environmental Protection Agency. Characterization of Coal Pile Drainage. EPA 600-7-79-051. 1979.

\_\_\_\_\_. The Environmental Impact of Coal Transfer and Terminal Operations. EPA 600/7-80-169. 1980.

\_\_\_\_\_. Report Synthesis of: Fugitive Dust from Western Surface coal Mines. EPA 600/7-80-158. 1980.

\_\_\_\_\_. Source Assessment: Water Pollutants from Coal Storage Areas. EPA 600/2-78-004. 1977.

\_\_\_\_\_. Sources and Transports of Coal in the Duluth-Superior Harbor, EPA 600/3-80-007. 1980.

\_\_\_\_\_. Static Coal Storage - Biological Effects on the Aquatic Environment. NERC-R-803937-02-0. 1980.

\_\_\_\_\_. Static Coal Storage - Chemical Effects on the Aquatic Environment. EPA 600/3-80-083A. 1980.

Virginia Port Authority. Coal Terminal Feasibility, Study. 1981.

Washington Public Ports Association, Port Systems Study, Volume II, Technical Supplement/Part 5 - Marine/Port Technology Forecasts and Demand Analysis. 1975.

\_\_\_\_\_. Ports System Study for the Public Ports of Washington State. 1980.

Washington State Dept. of Commerce and Economic Development. (Communication of) Report Regarding Potential Ports to Handle Bulk Commodities. September 30, 1980.

Weibe, John. Environment Canada Personal Communication. 1982.

Western Governors Policy Office. Western Coal Exports to the Pacific Basin. 1982.

Wisconsin Division of State Energy. Coal Transportation to Wisconsin: An Overview. 1982.

## APPENDIX A

### DETAILED ECONOMIC ANALYSIS OF IMPACT AVOIDANCE MEASURES

#### Costs of a Typical Coal Operation

Costs for a coal operation are estimated for five major categories. These costs are added to the original cost of coal at the mine and evaluated on a per ton basis. The cost categories (excluding land costs) are:

- o Capital costs
- o Operations and maintenance costs
- o Rail transport costs
- o Shipping costs
- o Overhead and Profit

Normal environmental protection measures such as dust suppression equipment, provision of buffer zones around the site, and efficient drainage design are assumed to be included. Each cost category is described separately.

#### Capital Costs

The scope of this study does not permit detailed costing of coal terminals, so other studies have been used for general cost estimates. The WESTPO study estimates capital costs to vary from \$7 to \$12 per ton of annual throughput capacity. This compares with Swan-Wooster's estimates of \$8 per ton at the proposed Tongue Point Coal Facility. An estimate of \$8 per ton (in 1982 dollars) is used here for the typical facility, with the assumptions that the terminal has one berth and is located at a site where existing ship berth and navigation channel depths are at least 65 feet; where no significant foundation problems exist; where the site is flat and above the flood plain so that extensive excavation and filling is not required; and where no lengthy rail spurs or highway access from main transportation routes need be developed.

For this analysis, an annual throughput capacity for a coal terminal of 10 million short tons per year is assumed, for a total cost of \$80 million in capital costs. According to WESTPO, a percentage breakdown of the major cost components of a coal terminal is as follows:

- o General Facilities - Site preparation, buildings, utilities, roads, drainage, coal yard air and water environmental controls, and electrical transmission lines . . . . . 15%
- o Coal Unloading and Stacking - Rail car positioners and dumpers, stackers, conveyors, inbound coal weighing and sampling . . . . . 25%
- o Coal Reclaiming and Shiploading - Coal reclaimers, conveyors, metering or surge bins, shiploaders and outbound weighing, and sampling . . . . . 40%
- o Marine Facilities - Trestle, pier, fendering, dolphins, and moorings . . . . . 10%

- o Control Systems - Instrumentation control panels, computers, inventory and management reporting systems . . . . . 3%
- o Railroad Facilities - Onsite tracks, ballast, turnouts, switches, signals . . . . . 7%

Table 1 details the capital costs for the typical coal terminal, broken out according to the WESTPO estimates, with the exception that standard pollution controls are itemized at 6 percent of total cost. The total costs also are assumed to include a 10 percent contingency factor, as well as initial engineering and procuring costs. Annual facility amortization costs are assumed to be \$12.8 million per year, based on a 20-year expected life and a 15 percent long-term interest rate.

TABLE 1  
CAPITAL COSTS FOR "TYPICAL" COAL FACILITY  
(Excluding Land Costs)  
(1982 dollars)

<u>Component</u>	<u>Cost</u>
General facilities	\$ 7,200,000
Coal unloading and stacking	20,000,000
Coal reclaiming and shiploading	32,000,000
Marine facilities	8,000,000
Control systems	2,400,000
Railroad facilities	5,600,000
Environmental controls	<u>4,800,000</u>
	\$80,000,000

Sources: WESTPO, 1982.  
WK&A, 1982.

#### Operations and Maintenance Costs

Ongoing operating and maintenance costs for the typical coal facility range from \$.80 to \$1.50 per throughput ton, according to the WESTPO study. Swan-Wooster estimates \$1.25 per ton for the Tongue Point facility. WESTPO also describes a typical distribution of annual operating costs.

- o Labor and Fringes - Cost of administrative and direct labor, employment cost, and fringe benefits . . . . . 50%

- o Supply Cost - Utility service, maintenance and operating supplies . . . . . 20%
- o Insurance and Taxes - Property and liability insurance, state and local taxes (does not include federal income taxes) . . . . . 20%
- o Miscellaneous Items - Legal, accounting, telephone, travel, sales, equipment rental . . . . . 10%

Table 2 details operating and maintenance costs for a typical facility by WESTPO category. An average cost per ton is assumed to be \$1.25 for the 10-million-ton-per-year facility. Amortized capital costs are also added to show total annual costs for the coal terminal. In addition, cost per ton is calculated and compared later in this section to the total delivered cost of coal to Pacific rim countries.

TABLE 2  
ANNUAL COSTS FOR "TYPICAL" COAL FACILITY  
(1982 dollars)

<u>Category</u>	<u>Cost</u>
Amortized capital	\$12,800,000
Labor and fringes	6,250,000
Supply cost	2,500,000
Insurance and taxes	2,500,000
Miscellaneous items	<u>1,250,000</u>
Total annual cost	\$25,300,000
Cost per ton	\$2.53

Sources: WESTPO, 1982.  
WK&A, 1982.

#### Rail Transport Costs

An average coal train is estimated to be 100 cars long, with each car carrying 100 tons, for a total volume of 10,000 short tons per train. Swan-Wooster estimates current rail tariffs to be about 1.7 cents per ton mile. According to Burlington Northern, the average distance from Powder River mines in Montana to Washington ports is about 1,180 miles. Using these assumptions, the annual basic rail cost for the typical 10-million-ton-per-year coal facility is about \$200 million, or \$20 per ton.

### Shipping Costs

Freight rates for coal-carrying ships are estimated to be between \$12 and \$20 per ton to Pacific Rim countries, depending on ship size. An average ship size of 70,000 dwt is assumed, based on the average ship size servicing Roberts Bank, British Columbia. It is also assumed that typical coal ships will be traveling to Japanese destinations. As a result, an average rate of \$16 per ton of coal is used, for a total annual base shipping cost of \$160 million.

### Overhead and Profit

Coal terminals are currently very risky investments requiring a fairly sizeable expected return on investment. An analysis assumption is made of an initial cash contribution of \$16 million, or 25 percent of the \$80 million coal facility. The annual rate of return on the initial cash contribution will be at least 25 percent before taxes, or \$4 million per year. These numbers could vary significantly depending on the type of financing and tax advantages for coal terminal development. However, the assumed amounts should give a general estimate of profit required by investors on a coal facility.

Overhead can vary widely as well, but an acceptable figure would probably be 25 percent of annual operating costs for the terminal. Earlier in this section, those operating costs were estimated to be \$25.3 million. Thus, estimated overhead costs will be approximately \$6.5 million annually.

Total overhead and profit is estimated to be \$10.5 million per year, or \$1.05 per ton for the 10-million-ton-per-year-capacity coal facility.

### Total Cost of Coal

The total delivered cost of coal from a typical Washington coal port to Japan is summarized in Table 3, by cost category. As shown, it is assumed that Powder River coal will cost \$10 per ton at the mine, only 20 percent of the delivered cost of coal. Transportation by rail and ship accounts for almost three-fourths of the delivered cost, while the actual facility costs, including amortization and O&M costs, make up only 5 percent of the final cost per ton.

For purposes of this study, standard environmental protection costs are estimated as a portion of the total cost of coal. As shown, the costs are very small when compared to the final delivered cost of coal. The remainder of this chapter will look at the costs of nonstandard environmental protection measures and their potential impact on the financial feasibility of a typical coal terminal.

TABLE 3  
COST OF COAL, BY CATEGORY

<u>Category</u>	<u>Cost per Ton</u>	<u>% of Delivered Cost</u>
Facility amortization	\$ 1.28	3%
Operation and maintenance	1.25	3%
Rail transportation	20.00	40%
Shipping	16.00	32%
Overhead and profit	1.05	2%
Coal at the mine	<u>10.00</u>	<u>20%</u>
Total delivered cost	\$49.58	100%
Environmental Protection (amortized capital, O&M)	\$ .10	.002

Effect of Impact Avoidance Measures on the Financial Feasibility of a Coal Terminal

Several impact avoidance measures have been identified that would add significantly to the delivered cost of coal. Since the total cost of coal is the most important indicator of feasibility, each impact avoidance measure is evaluated by its impact on delivered cost.

Impact avoidance measures can be grouped into three categories, described below:

- o Habitat Management - Involves the actual mitigation of habitat disruption caused by construction of the coal terminal facility, including eelgrass replacement, artificial reef construction, and new wetlands creation.
- o Operational - Impact avoidance measures generally deal with standard environmental protection devices already built into the coal facility. These devices control air and water quality, and noise impacts at the site.
- o Community-Related - Impact avoidance measures directly affect communities surrounding the coal facility site. Examples of community impact avoidance measures are replacement of lost recreational uses, restriction of rail travel in towns, railroad grade separations, and cooperation with commercial fishermen using waters near the site.

In evaluating the financial impact of these impact avoidance measures, all capital outlays will be amortized over the 20-year life of the project and

operations and maintenance costs will be given as constant annual amounts. Each impact avoidance measure will first be described; its costs will then be estimated and compared to the total cost of coal. The final section will suggest alternative impact avoidance measures, both for specific impacts and for groups of impacts.

#### Habitat Management

Coal terminal sites often are located on lands and in water that have existing wildlife, fish, and plant habitats. Destruction or disturbance of these habitats may require impact mitigation in the form of eelgrass bed replacement, artificial reef construction, and/or wetlands creation. The cost of habitat replacement can be minimal depending on the site. At Roberts Bank, British Columbia, total estimated costs of habitat management are \$1 million in initial costs and \$100,000 in annual monitoring costs. Wetlands creation can be as high as \$100,000 for 10 acres, plus \$5,000 per year for operations of water pumps.

A high estimated cost for habitat management is \$1.5 million, or \$240,000 per year in amortized costs, plus \$100,000 in annual monitoring and maintenance costs. Total impact on the price of coal is:

#### Habitat management

costs: \$340,000 divided by 10,000,000 tons per year =  
\$.03 per ton per

#### Operational Measures

Most operational impact avoidance measures have already been included in the basic cost of the typical coal facility. Examples of standard environmental protection devices are dust control mechanisms, coal sprays, muffling of engines used onsite, turning off locomotive engines while unloading, and proper treatment of water runoff.

However, the presence of nearby recreational or residential areas could require covering coal piles to further control coal dust contamination of air in surrounding areas. Covering coal piles can be very expensive, with estimates ranging from \$20 to \$50 million for initial capital costs, depending on whether silos are built or a less sturdy apparatus is used to control coal dust. Operating costs can also be prohibitive if the coal conveying system is substantially changed.

An estimated high cost is \$50 million, or \$8 million in annual capital costs, for a storage silo and an added \$1 million for annual operating costs, based on discussions with a coal developer. Total impact on the price of coal is:

#### Coal covering

costs: \$9,000,000 divided by 10,000,000 tons per year =  
\$.90 per ton per year

A second potential operational impact avoidance measure is the restriction of facility operations to daylight hours to alleviate noise impacts. In discussions with developers, restriction of operations to daylight hours would cause a considerable problem because of the uncertainty of train

arrival times. A 10-million-ton-per-year facility would have about three trains arrive per day. Operational restrictions of 8 to 12 hours per day would cause considerable delays and queuing problems for trains which would be either unacceptable to railroad companies or very expensive to the terminal owners.

Based on a conservative demurrage rate of \$200 to \$300 per day per train, an added cost of about \$300,000 per year (one day per train at \$300 per day) is estimated. However, rail companies also are likely to build continuous demurrage into their base rate. An increase of even one-tenth of a cent per ton per mile can increase total coal price by almost \$1.15 per ton annually. It is more likely that railroads would raise their rates even more to discourage constant demurrage of trains.

In addition, ships could be delayed by restricted operations. Ship demurrage is between \$10,000 and \$25,000 per day, although provisions are made for "free days" of about one to two days at each end of the route. About 150 ships a year are needed at a 10-million-tons-per-year facility, one every two to three days. Ships are generally allowed one day to load plus the free time allowance. If every ship averages only one day of demurrage (at \$25,000 per day), annual costs would be \$3.75 million.

Total estimated impact of restricted operations on cost of coal is:

Train demurrage:	\$ 300,000
Rate increase:	\$11,500,000
Ship demurrage:	<u>\$ 3,750,000</u>

\$15,550,000 divided by 10,000 tons/year =  
\$1.56 per ton per year

NOTE: It is likely that rail rate increases will be higher than one-tenth of a cent. Further, the restriction of facility operations to daylight hours could preclude further consideration of the site as a potential coal terminal altogether.

#### Community-Related Measures

Impact avoidance measures that directly impact surrounding communities are discussed in this section. Three subcategories examined include: replacement of recreational opportunities, management of commercial fishing near the site, and railroad impacts on surrounding communities.

Replacement of Recreational Opportunities: In some cases, coal terminals may reduce or totally eliminate recreational uses near the site. Mitigation of these impacts can vary greatly depending on the location of the coal site. Based on discussions with developers and agency personnel, the cost of an average 25-acre alternate site is about \$250,000 in one-time costs, or \$40,000 in annual capital costs. The site would likely be turned over to local park departments for development and management. Total impact on the cost of coal is:

Cost of  
alternative  
recreational  
site:

\$40,000 divided by 10,000,000 tons per year =  
less than \$.01 per ton per year

Management of Commercial Fishing: Conflicts between commercial fishermen and shipping activities at the coal terminal can occur at certain sites. In areas where commercial fishing is significantly impacted, a management program may be necessary to allow cooperative use of waters near the site by both fishermen and coal ships. Estimated costs of a management program is \$200,000 based on experience at Roberts Bank, British Columbia. Total impact on the cost of coal is:

Commercial  
fishing  
management

program: \$250,000 divided by 10,000,000 tons per year =  
\$.03 per ton per year

Rail Impacts: Rail impacts to nearby communities include delays of traffic and noise to residents adjacent to the rail lines. Impact avoidance measures relating to rail traffic include grade separations, signalization at busy crossings, and speed limits on trains moving through towns.

Grade separations, or railroad bridges, are estimated by Burlington Northern to cost between \$1 and \$5 million in initial capital costs. The annual capital costs are \$160,000 to \$800,000 per year. Grade separations are necessary in areas where extreme traffic congestion can occur if heavy train travel blocks rail crossings.

The impact of one \$5 million grade separation, or \$800,000 in annual capital costs, on the total cost of coal is:

Grade

separation: \$800,000 divided by 10,000,000 tons per year =  
\$.08 per ton per year

Signalization at other busy railroad crossings is another community-related impact avoidance measure. The cost of signals at one crossing averages between \$85,000 and \$200,000. It is likely that several signalized crossings will be necessary for a typical coal facility. The impact of one signalized crossing on the price of coal is:

Signalization:

\$200,000 divided by 10,000,000 tons per year =  
\$.02 per ton per year (for each crossing)

Train speed limits in communities near a coal terminal is a third impact avoidance measure, designed to lessen safety problems caused by fast-moving trains. It is assumed that most towns already have train speed limits in effect and that railroads have already taken these slowdowns into account in their current rates. Thus, no quantifiable costs are attributed to this measure.

### Alternative Impact Avoidance Measures

Although only two impact avoidance measures have a significant impact on the price of coal (i.e., enclosure of coal piles and restriction of facility operations), a combination of other, more minor, impacts could substantially affect the total cost of coal. Alternative impact avoidance measures are described, which can mitigate similar impacts at a lower cost. Finally, a short discussion of potential funding for impacts concludes this section.

#### Habitat Management

Costs of habitat management mitigation are related to the amount of wetlands, eelgrass and other habitats affected by the coal terminal site. Since habitat replacement is necessary, reduced costs in this area can be achieved by initial site location in low impact areas. In addition, cooperation between developers and state agencies in a reasonable habitat management program worked out prior to construction of a terminal will avoid delay and added costs.

#### Operational Measures

Both operational impact avoidance measures identified in the previous section are estimated to have a significant impact on the price of coal. Enclosure of coal piles, which has an impact of \$.90 per ton or 2 percent of the total price of coal, can again be avoided by proper site location in an area where air quality considerations are less critical. Also, according to engineers for the Port of Portland, air quality standards can be met by proper dust prevention devices, including water sprays and crusting agents. They have estimated that coal dust emissions in the highly populated Portland area can be held to under 20 tons per year for their facility. This suggests that a combination of site location and state-of-the-art dust control devices should preclude enclosure of coal piles in almost every potential coal terminal.

Another operational impact avoidance measure which could significantly impact the total cost of coal is restriction of operations to daylight hours. The estimated cost of this measure is \$1.56 per ton, or 3 percent of the total cost of coal. As was previously pointed out, this is most likely a low estimate since this restriction of operations would almost certainly make the potential coal terminal financially infeasible.

The best alternative to restricting operations is to locate the terminal away from residential areas where noise from the terminal operation would be less disturbing. In addition, maximum effort to mitigate noise, including buffer zones surrounding the site, can help to alleviate the problem.

#### Community-Related Measures

All costs of community-related impacts, including location of alternative recreational sites, a commercial fishing management program, and railroad grade separations and signalization, are fairly small when compared to the total cost of coal. Again, appropriate site location can prevent most impacts in nearby communities, but a low level of community-related impacts can probably be absorbed by the developer without affecting the total price

of coal. Also, signalization and alternative routing of trains is preferable to construction of grade separations in nearby communities.

#### Funding Alternatives

Funding of operational impact avoidance measures, as well as habitat mitigation is required to be paid by the developer as part of the Washington state permit process. As discussed, if appropriate siting and state-of-the-art environmental protection devices are used, the costs of mitigation are relatively low.

However, funding of community-related impact avoidance measures is not always required in the permit process. Several alternatives are available for funding of these measures. State and federal funding are accepted for railroad grade separations and signalization. However, these funds have dwindled recently which suggests that developers of coal terminals will have to accept more responsibility for funding community-related mitigation measures.

It has been suggested by Canadian and Californian government officials that funds could come directly from terminal owners as part of the permit process, or from a surcharge on each ton of coal shipped through the terminal to be used for impact mitigation in nearby areas. Five cents per ton has been suggested as a reasonable surcharge, or about \$500,000 per year at a 10-million-tons-per-year facility. Total impact of the five cent surcharge is only one-tenth of one percent of the total delivered cost of coal, \$49.58 per ton, estimated previously. A variation on these types of funding is to have developers fund capital costs up front, and to use surcharge monies to finance ongoing impact mitigation programs.

